RAILROAD GAZETTE

FRIDAY, APRIL 10, 1903.

CONTENTS

Contributions

The Railroad Trade Unions.

[An unusual number of letters have been received by the *Railroad Gazette* from railroad officers, commenting on the editorial articles discussing the railroad labor situation which have appeared during the past four weeks. For obvious reasons these officers do not want their names or their companies to appear in this discusison. It is permitted, however, to publish extracts from a few of these letters. It is easily seen that they are, for the most part, hastily written impressions, but this has a value in showing to some extent the present attitude of some of the higher officers who are trying to solve the problem. To each letter is added the officer's title, but the name and the road is omitted.]

. . . The present conditions of labor will precipitate, in my opinion, the next financial crisis.

..... President.

We are facing the same causes that have contributed so largely to England's commercial decline—the limitation of individual exertion and the leveling down, instead of the rising up, process. I must confess that I do not see much remedy for it just at present. The public seem to hail with delight every notification of an increase in wages in any vocation, seemingly disregarding the fact, from which there is no escape, that the public finally "pays the freight."

It all comes back to the question of a close personal touch between the immediate operating officer and his men, and that can only be secured where officers have been a sufficient length of time on the property to become personally acquainted with their men and to know the material they are dealing with; and where the men come to believe in the permanency, as well as the fairness, of their officers. One of the most fruitful causes of trouble is the continual shifting of general and division officers, especially the latter.

..... President.

Unions are not, as a rule, beneficial to their members. In many cases there are enough conservative men in an order, or branch of an order, to make it prolific of good to its members and the public. While themselves unwilling to provoke discord, and counselling moderation, they yet are willing the agitators should gain advantages if they can. Once an issue is provoked by the noisy men, the issue of whether they shall be supported is brought to the fore, and chaos may come. I argue for patience and tolerance with the agitator (among a company's own men) at the beginning of uneasiness. An out and out orator, converted by reason, and in sympathy with his employer, becomes a power for good. The standing upon the fact that the troublesome men are few, relatively, and may therefore be ignored, or followed, and, perhaps, dropped, I regard as a mistake, and one which has, in many cases, thrown the majority against the company.

..... President.

My theory is that the present epidemic of labor unrest is largely the result of contagion and that as heroic measures are needed to check the disease as if it were small-pox. I disagree to some extent that professional agitators are primarily responsible for the state of affairs. In my judgment it was provoked, or at least in large degree might have been prevented by earlier study into the laborer's needs and cravings, and greater deference to them by employers. Some years ago I met a dozen bright looking young men coming out of the office of a railroad official upon whom I was calling. "Who are your friends?" I asked. "A committee of trainmen wanting a lot of concessions," he replied. "How did you come on with them?" "I told them to get to hell out of here." I imagine he did not use those words to them; but that he was imperious and overbearing I have no doubt. He was sowing seed for discontent when opportunity for fraternizing was brought to his door. Multiplication of the process gives the oratorial "friend of the laborer" his opportunity and establishes his vocation. It is American for the masses to sympathize with a man who, without sufficient provocation, is first hit.

..... President.

I have read with much interest the editorial articles in the *Railroad Gazette*, and most heartily approve of your plan of studying the conditions governing unions, and formulating some plan by which railroads can be governed in dealing with the various unions with which they come in contact. So far as this road is concerned, the principle by which I am governed is not to recognize any union; to deal with employees who have grievances, directly, and not because of their belonging to any union, or through any union officers.

..... General Superintendent.

I have read with great interest and pleasure the editorial articles in the *Railroad Gazette*. They show such a thorough knowledge of the subject (which, by the way, I consider to be the most important matter pending in the industrial and financial world) and are so ably and temperately treated that I hesitate to suggest any change.

Something must be done to check the present wild onslaught by organizers, or the country will be plunged into financial panic and possibly revolution. If your articles and other similar editorials and items I have read in the *Railroad Gazette* could be put in the hands of every workman, particularly railroad employees in every grade, in attractive book or pamphlet form, they would exert a tremendous influence for good.

The subject, in all its phases, must be treated from the standpoint and in the spirit you have adopted. The men must be taught to see that they are on the verge of a disaster which can only be averted by their halting to take a sober, honest, courageous stand against wrong on the part of their leaders or employers.

There is also much room for improvement in the methods of some corporation officers, who should understand that the time for brow-beating and taking advantage of their men has passed.

I think it is generally understood that organizers could not have succeeded as they have if employers had shown a disposition to treat their men with proper consideration. Where a body of men has confidence in the honesty and friendship of the management the organizer is a failure. Rigid discipline can be maintained where justice rules and the rank and file feel that those in authority have a personal interest in their welfare, and will further their interest impartially when it can be done with due regard for all interests involved.

The officer who cannot control his men as against the organizer should give up his place. Loyalty can usually be secured by a proper system to advance the men when it can be done and having it understood that a man's position is his own just as much as his watch and pocketbook as long as he shows the proper disposition to safeguard it. The men should feel that in time of misfortune they can look for sympathy from the company and the company can in many ways show an interest in the welfare and happiness of the men without any appreciable cost. Recent efforts to break down union organizations were as foolish as the attempts of the organizers to control the situation, and show clearly that employers must recognize more intelligently their responsibility in meeting the issue.

Everything depends upon education. Both sides are deficient in this respect, but of course only to a limited extent as far as the employers are concerned. It is their duty to reach the other side by precept and example and thus awaken in the ranks the feeling of honesty, courage, loyalty and intelligence. It is too late to hope to succeed by arbitrary, selfish, domineering methods, but this may not be understood in time to avoid disaster which would bring us all to a better realization of the dangers that surround us.

..... Vice-President.

I have read the articles written for the *Gazette*, with the sentiments of which I fully agree. As to a remedy for these ills, I am at a loss. The general ferment throughout the world of labor seems to be hastening to some conclusion; whether it will be the destruction of capital or the defeat of its enemies time only will show. For myself, I am not now in the active work of the railroad, and am glad of it, for I see in the future troubles for those that are. From the munificent salary of $20 per month, at which I commenced railroad work, what little advancement I have made was not by the help of any union. I never "watched the clock," or was ready to quit until the work was done, and this is so entirely different from the plans of the union that I can have no sympathy whatever for the idea of placing all men on a level and give none a chance to rise. Wishing you, however, abundant success in your endeavors, I am

..... President.

I have read with interest your editorials on the labor problem. In all the dealings I have had with the brotherhoods in the train service I have found them well disposed and willing to treat fairly with the railroad company, and I believe if they are met by the officers of the railroads and full and free discussion is had, that there will never be any difficulty with these orders. I refer particularly to the enginemen, firemen, conductors and brakemen. They do not take the ground that a man must belong to the order in order to work. We have a number of men in our employ in the callings mentioned above who are not members, and yet get the same treatment and the same rates of pay as those who are members. With the machinists and shopmen the case is somewhat different. In some of the shops they are very strong and are not inclined to allow non-union men to work.

..... President.

I think my views concerning this matter differ somewhat from those held by many managing officers, possibly due to my early experience as a locomotive engineer, and a member of the Brotherhood of Locomotive Engineers.

There seems to be a feeling among railroad employees against the man who takes the side of his employers. I do not know why this is so; I simply know it is, and because of that the good men usually keep still and the bad men do the talking and manufacture the sentiment. I cannot help believing, however, that the great majority of the men to-day employed on the different railroads, especially in the east and central west, are disposed to be faithful and loyal employees. It has come about, however, that practically all the men in engine and train service are now identified with their respective brotherhoods, and there is no doubt that the brotherhoods are here to stay. It is to be expected, of course, that the brotherhoods, through their leaders, will make mistakes, as all other organizations do. The general tendency of such organizations will, of course, be in the direction of shorter hours for labor, and higher rates of wages with better conditions of employment. Those will be the ends sought, and inasmuch as the labor organizations are here to stay, it occurs to me that it is better to reckon with them; and until they show that they are altogether undeserving, treat them in a respectful and considerate manner. I cannot help thinking that when they are so met and so treated, better results will be obtained and a better feeling will exist between the companies and their employees, and better work will be performed.

If all wages could be worked out on a sliding scale, this, I think, would come nearer settling the wage question than any other thing possible. This can be done in many lines of employment. So far, however, it has not seemed possible to work out such a scheme so far as train and engine service is concerned. I think railroad officers make one mistake in keeping too far away from their men. Railroad employees are of average intelligence, and as they continue in the service and reach higher positions, their intelligence becomes keener, if such a thing is possible, and their understanding is improved.

They are more or less subject at all times to the influence of their brotherhoods and are forced to listen to discussions among other employees concerning conditions of service, and I happen to know that the discussions which take place about the roundhouse stove, in the caboose and in the boarding houses, dwell upon the hard trips, and the long hours on duty, and the inadequate pay for such work, rather than upon the quick trips, easy work and such good features as may happen to attend or be incident to their employment; and inasmuch as employees are constantly hearing such discussions and occasionally listen to the oratory of some would-be agitator, it is not to be wondered at if they gradually reach the conclusion that they are an overworked and underpaid class of men.

Someone ought occasionally to speak to them in behalf of their employers, and who better could do this than the officers under whom they are employed? I cannot help thinking that if the operating officers could occasionally meet with the men in their lodge rooms, or at some proper place, and talk to them concerning the matters which they are all vitally interested in, explain to them the general policy of the company concerning its men, and try to show them, if it is a fact, that their conditions of employment are no more onerous than they are on other roads similarly situated, and that their earning power is equally as good, that much good would result therefrom. I believe that railroad officers are largely responsible for the activity which we see displayed among the various brotherhoods.

It may be that the time is now past when any good can come from active work on the part of the railroad officers towards educating their employees and directing their thoughts along better channels. It may be that the time for this has passed, but I am not convinced that such is the case. No doubt the matter has been so long neglected that a greater effort will be required at this time to accomplish much good than would have been necessary some years ago. So far as my observation goes, human nature is very much the same wherever it is found. Men think in much the same channels and their feelings are not dissimilar.

I believe that the operating officer of a railroad can

have as much influence with his men, if he sees fit to exercise it, as any officer of the various brotherhoods. The trouble is, railroad officers do not see fit, as a rule, to use their influence. If they do not actually shun the men, they certainly in many cases try to ignore the fact that brotherhoods do exist and that the action of their men is largely influenced thereby. I cannot see that anything is to be gained by refusing to recognize the fact (and it seems to me very well established as a fact), that the brotherhoods are here and will continue and must be reckoned with; and I cannot help thinking that better results will be obtained if they are met frankly, fairly, honestly and fearlessly, than if the opposite course is pursued, and, so far as possible, treated as if they did not exist.

I do not know that what I have said above is of any value to you. It is a fact, as you suggest, that the question which you have taken up is one of vital importance and I should like to see it discussed through the columns of the *Railroad Gazette*.

..... General Manager.

Where Foundation Is Difficult.

Salt Lake City, March 28, 1903.

To the Editor of The Railroad Gazette:

There is a hole in great Salt Lake that is puzzling geologists and engineers, and giving the Southern Pacific Railroad Company more trouble than it ever bargained for when the Lucin Cut-off was contemplated. In the first place, several hundred feet of the track already built sagged from six to ten inches a short time ago, and now the work has progressed until there is a bottomless pit into which piles, and rails, and thousands of tons of earth and rocks have been dropped, all to no effect apparently. Opinions as to just what this is have varied widely, and all kinds of theories have been advanced from that of the bottomless pit to that of a subterranean outlet, similar to that of the Humboldt river in Nevada.

State Engineer Doremus, who made a detailed examination of the lake bed years ago, is of the opinion that the obstacle is merely a soft place, and not bottomless. He believes that a sufficient quantity of material is all that is needed. Prof. Talmage, a geologist of note, and president of the State University, also refutes the theory that the place is a bottomless quagmire, and states that the site was probably at one time the bed of the Bear river, which has since been filled with alluvium which is not solid enough to bear the weight of the trestle work.

The soft places could be overcome by spanning, but the railroad company is considering whether it would be cheaper to span at this time or continue to fill in. The plan of spanning would have been cheaper in the first place. It is a perplexing problem, and one which will take time and a great deal of money to solve.

James T. Goodwin.

Frictionless Side Bearings.

Chicago, March 13, 1903.

To the Editor of The Railroad Gazette

In the *Railroad Gazette* of February 20 is a communication from Mr. John Kirby on Center Plates, Side Bearings and Flange Wear; also an editorial on the same subject. These are questions that are always worthy of serious consideration and they should interest every railroad operating man. For a reduction in the cost of wheel wear, and, what is of greater importance, a saving in cost of operation, due to a reduction of rail wear and expenditure of power, are possible through a solution of the problem these questions involve.

While it may be the general impression that cars are carried on the center plates, as they are intended to be, an inspection of several thousand cars did not prove this to be so; and the majority of car builders will concede that at least 75 per cent. of all the cars running, when under load, rest on their side bearings. We find a few of the new metal body bolsters that are stiff enough to carry the load, and keep the side bearings free, but time only will demonstrate how long they will continue to do so. The fact still remains that over 1,000,000 of our cars are carrying a large part of the load on the side bearings. These are the cars that are causing the great expense for wheel and rail wear, and are the ones which require immediate attention. On this account is it not more essential to devote our time to the question of side bearings, rather than to that of center plates? There is no doubt but that the center plate is a factor in the question, but a very small factor compared with the ordinary side bearing.

The power required to swing the trucks on entering or leaving a curve is dependent on the leverage to be overcome. On an ordinary freight truck, the distance from the center of the truck, or the king bolt, to the point of contact between the wheel and rail is about 42 in. Our center plates are from 12 to 14 in. in diameter. Under these conditions we have 42 in., as the long arm of a lever, operating against 6 or 7 in. as the short arm, or a leverage of 6 or 7 to 1, to overcome this resistance. In the case of the side bearing we have the same 42 in. for the long arm, operating against a short arm of 30 in., or a proportion of 1.4 to 1. As a result it requires over four times the power to swing the truck when carrying the load on the side bearings, over what it would if they were free, or equipped with frictionless side bearings. This has been practically demonstrated in thousands of cars which have already been equipped with these bearings, showing a great reduction in flange wear as a result.

Mr. Kirby says "it is beginning to dawn on the minds of some that a portion of the load should be carried on the side-bearings." What objection is there to this form of construction? We all concede that our center plates would be better if they were larger; and where is the difference between a center plate 60 in. in diameter, and the ordinary center plate with frictionless side bearings placed 60 in. apart, and operating on this same radius? It only seems to be extending the center plate to the extreme limit.

It is often assumed that carrying the load, or part of it, on the side bearings would result in unequal and excessive pressures which would prove destructive to both bolster and truck; but what reason exists for this assumption? No engineer would consider it a difficult problem to design a bolster 10 ft. long by 8 in. deep, resting on three supports, to carry a load of 20 or 25 tons, equally distributed; while experience has taught us that it is a very difficult problem to design a bolster of these same dimensions, resting on one center support, and capable of carrying this load without excessive deflection. In the truck bolster we are not confined to any particular depth and our supports are almost exactly under the side bearings. On this account where is there any destructive pressure on the truck by carrying the load on the side bearing, directly over the supports, rather than on the center plate and transmitting the load through the bolster to these same supports?

The question of a suitable side bearing to meet all the emergencies of this service is of much more importance than that of supporting the load. Cast-iron rollers of all kinds have been used to a greater or less extent for the last 40 years; single, double, straight-face and conical; some rolling on their circumferences, some supported on trunnions; and there is no doubt that they have been efficient for a time, but they all develop the same defect, namely, they wear flat. On this account they have almost gone out of service. The weight to be supported is excessive and the bearing surface so small that any inequality in the roller, or on the surface on which it travels, tends to prevent its free movement.

But the principal cause of these rollers becoming flat is one that can never be overcome in this form of construction. When one of these rollers has traveled to the limit of its movement in one direction, a sudden roll of the car will often leave it in that position, and if the next curve requires further travel in the same direction the body bearing will slide over the roller instead of revolving it on its bearing. As a result the roller is ground flat, the dirt on the rough cast-iron surfaces acting as a good cutting material; and when a flat spot is once started it only requires a short time to destroy the efficiency of the roller.

A frictionless, or roller side bearing to be efficient must be free to move in either direction under any condition; the rollers should be perfectly round and of sufficient size to support any load which they may be required to carry; they should operate on or between perfectly smooth hard steel plates, and should be so arranged that they will instantly return to their normal position when the load is released. The rollers should also be protected by a plate or cover which would relieve them from the wear of the body side bearing, and protect them from ice and dirt.

A roller bearing of this design will meet the requirements of any kind of service, freight or passenger. And if such bearings have proved satisfactory under passenger equipment, which we all concede, why should they not prove fully as satisfactory under freight equipment? The cars are operated over the same tracks; the new passenger equipment is as heavy as the ordinary freight equipment, so they would not have any greater load to support; and if it is a question of reduction in the cost of operation, it is essential to equip all cars whether new or old.

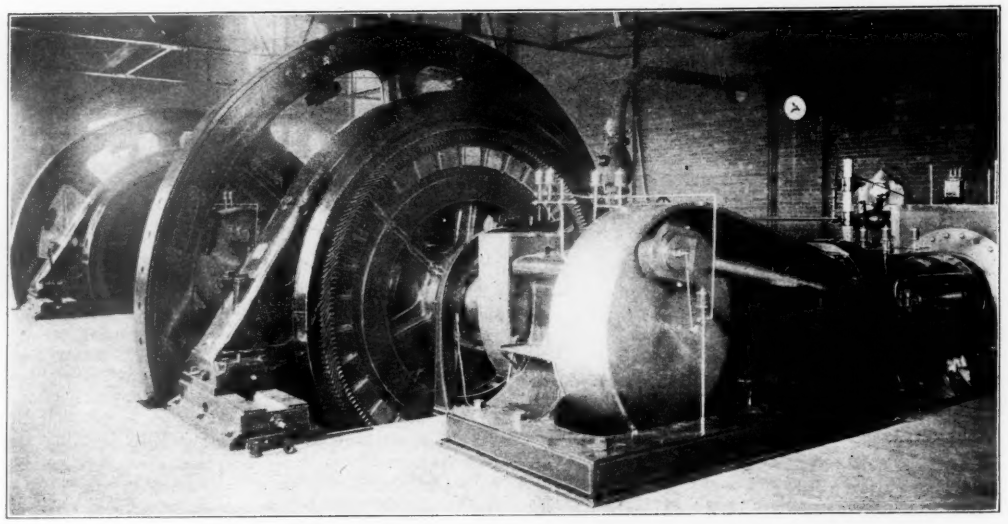
H. M. Perry.

The White Star (Steamship) Line, which has become a part of the International Mercantile Marine Company, has distributed $187,500 to its old employees. Some of the officers got several thousand dollars apiece.

The Electrification of the Cincinnati, Georgetown & Portsmouth.

by E. M. Stevens, *General Superintendent.*

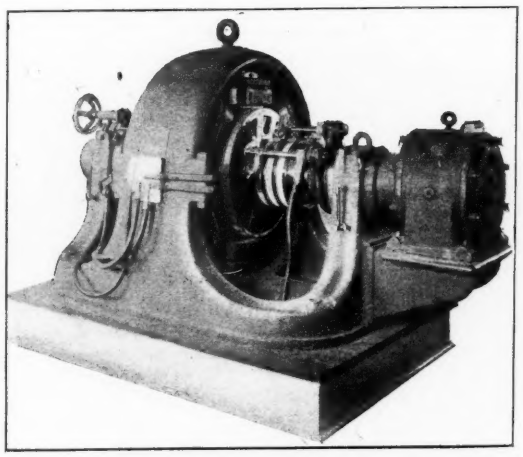
The Cincinnati, Georgetown & Portsmouth was organized in 1872. The company was chartered to build a railroad from Cincinnati, through Clermont, Brown, Adams and Scioto Counties to Portsmouth, Ohio. The road was first completed to Bethel, Clermont County, as a narrow gage railroad, but was afterward extended to Georgetown. On Oct. 1, 1901, the road was purchased by A. W. Comstock, of Detroit, Mich., and W. R. Todd & Company, of Cincinnati, Ohio. Plans were immediately made for changing from narrow to standard gage and for using electricity instead of steam. During the past year this change has been going on and several extensions have been added to the original road. A branch has been built to Coney Island, and from the power house at Olive Branch, about 15 miles from Cincinnati, another branch line has been built to Batavia, Ohio, the county seat of Clermont County, connecting the main line with the Norfolk & Western. New 70-lb. steel rails have been laid over about one-half of the 50 miles of the road, the other half having been recently laid with 60-lb. steel rails. There were 37 wood and steel trestles on this road but nearly all have been filled up with earth and the balance have been strengthened. The company owns valuable terminals in the city of Cincinnati, where it has connection with the Pennsylvania. A right of way has been secured and the survey completed from Georgetown east to West Union, Ohio, a distance of 23 miles. The maximum grade on this extension will not exceed 1 per cent. The average grade of the main line is less than 1 per cent. It is expected that an average speed of about 40 miles an hour will be maintained.



Generating Set, 600 Kilowatt—Power House of the Cincinnati, Georgetown & Portsmouth.

The power house at Olive Branch is built of brick and concrete. The following is abstracted from a description of the power plant by Mr. James Bryan, Electrical Engineer.

The power house building, including boiler and engine rooms, is 151 ft. 10 in. x 95 ft. 10 in. The building is brick with steel roof trusses and slate roofing. The boiler house is arranged for four batteries of "Cahall," Babcock and Wilcox water tube boilers of 500 h.p. each; there being two 250 h.p. boilers in each battery. Three batteries are now in place. The other equipment includes two Worthington boiler feed-pumps, each of 2,000 h.p. capacity, and one 2,000 h.p. Stillwell-Bierce open heater. The coal storage is alongside the boiler room and cars can be run on a trestle and the coal dumped into the bin by gravity. One end of the engine room is partitioned by a brick wall for the transformer room. At the other end is the pump pit, 22 ft. x 45 ft. and 14 ft. deep.



Rotary Converter, 150 Kilowatt—Substation of C. G. & P.

Two cross compound 24 in. and 44 in. x 42 in. condensing Hamilton-Corliss engines are now in place. Direct connected to these engines are two Westinghouse

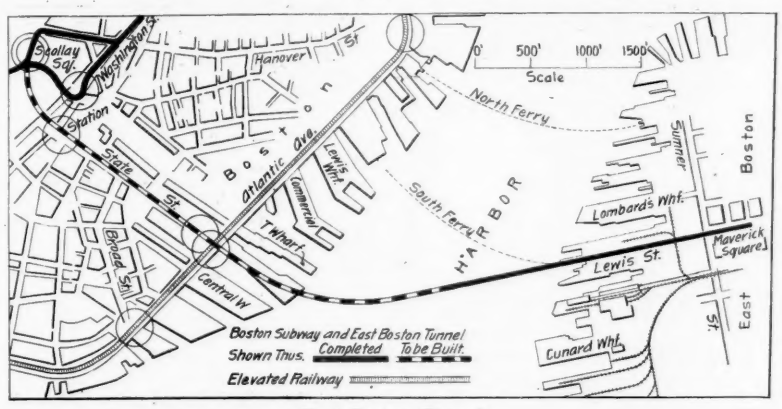
600 k.w., 3,000 alternations, 360 volt, three-phase alternating current generators. There is also a Harrisburg exciter engine, direct connected to a 50 k.w. Westinghouse generator; also one Westinghouse motor driven exciter set, consisting of a 75 h.p., 360 volt, three-phase motor, direct connected to a 50 k.w., 110 volt generator. Two 250 k.w., 25 cycles, 360 volt, a.c. 600 volt d.c. rotary converters are provided, together with marble switchboard, for the control of the generators and rotary converters, and having panels for the long distance transmission circuits. In the transformer room are six 200 k.w., 360-15,000 volt step up transformers together with circuit breakers and lightning arresters. One central condenser serves all the units. The water supply was obtained by building a dam across a natural ravine, through which flowed a small stream. The lake thus formed is about 300 ft. x 3,000 ft., with an average depth of about 16 ft.

Three sub-stations, one each at Mt. Washington, Bethel and Sunshine, feed current to the line five miles each way. These sub-stations also serve as freight and passenger stations. The sub-station at Mt. Washington is brick, 72 ft. x 30 ft. 3 in.; the freight room, occupying 13 ft. of the length, and the waiting room 13 ft. of the length; the middle portion containing the electrical apparatus. The electrical apparatus installed in this substation is as follows: Two 250 k.w., 360 a.c., 600 volt d.c., 25 cycle Westinghouse rotary converters, and three 200 k.w., 360-15,000 volt step-down transformers.

The rolling stock consists of ten 50 ft. closed passenger cars of the Pullman type, built by the St. Louis Car Company and equipped with four 60 h.p. Westinghouse motors, each; also six 40 ft. open cars and six 40 ft. closed cars, built by the Cincinnati Car Company. There are also two express, mail and baggage cars equipped with four 60 h.p. Westinghouse motors each, and one combination baggage and passenger car; ten standard flat cars, equipped with Westinghouse air-brake and automatic couplers; ten standard coal cars; ten standard box cars and ten standard stock cars.

The East Boston Tunnel.

The East Boston Tunnel is an important part of the general scheme of rapid transit for the city of Boston authorized by the Legislature of 1894, the Act of that date being the result of an agitation extending over many years. A Rapid Transit Commission of eight members, appointed in June, 1891, had investigated, at a cost of $50,000, the whole problem of rapid transit to and in the city. Its recommendations included changes in the steam road terminals and the development of two routes for traffic through the city, one of which should be an elevated railroad, the other a subway or tunnel. These proposals were referred by the Legislature of 1892 to the Legislature of 1893, which created a special committee of 15 to deal with them. Forty hearings were devoted to the discussion of the problem, with the result that two Acts were passed in the latter year. One of these, providing for what was known as the "Alley" route of an elevated railroad between Washington and Tremont streets, and extending thence in each direction through the heart of the city, was made subject to referendum and was rejected by the citizens of Boston at the ensuing State election. The other provided for the creation of a Board of three Subway Commissioners, with authority to construct a subway or subways over a route about a mile long. The Act was not to take effect unless adopted by the Boston City Council.



East Boston Tunnel.

This was done, and on Jan. 1, 1894, the members of the Commission were appointed. In the following month they reported in favor of amendments to the Act, extending the northerly portion of the proposed subway route to the vicinity of the northern steam railroad terminals, and making provision, in the opposite direction, for access to the subway for cars from additional city districts. These recommendations, with modifications and additions, were finally incorporated in a composite Act (Statutes 1894, chap. 548), the first part of which provided for the incorporation of the Boston Elevated Railway Company, the latter for the creation of the Boston Transit Commission of five members, as it now exists.

The two parts of this act had no necessary connection with each other. The building of the elevated railroad, by a company formed to lease the undertaking of the West End Railway Company, was not made dependent on the building of the subway, neither was the building of the subway made dependent upon the construction of an elevated road, and the routes of the two were not the same. In addition to these more extended provisions, affecting the general problem, the powers given to the Commission, in regard to its special work, were in some respects greater than had been asked for in its report. They included the building of a tunnel from Scollay Square, near the northerly end of the proposed subway, under the harbor to East Boston, and the construction of a new bridge over the Charles River.

The latter scheme included provision for a two-track elevated street railroad above the ordinary road level; the bridge, built from the designs of City Engineer Wm. Jackson at a cost of $1,500,000, was opened for traffic on Nov. 27, 1899.

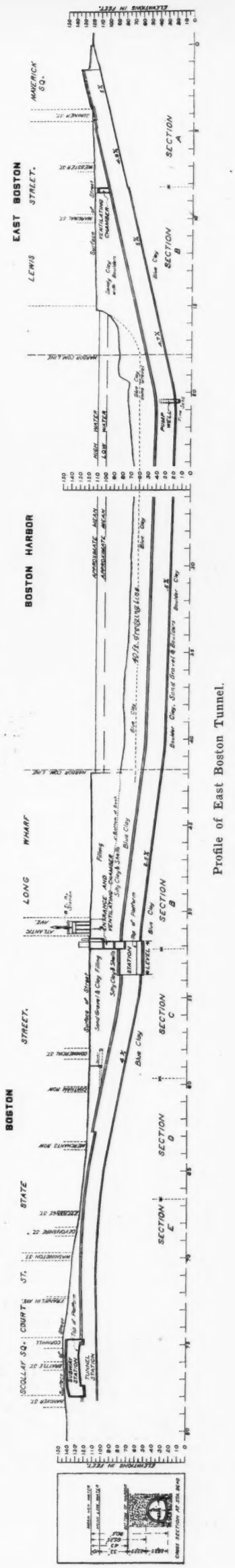
The limit of expenditure under the Act, not including the bridge, was fixed at $7,000,000, as compared with the estimate of $5,000,000 in the February report of the Subway Commission. The Act required that "all streets and places under or near which a subway is constructed shall be open for traffic between 8 o'clock in the forenoon and 6 o'clock in the afternoon," during the building of the works.

The Boston Transit Commission, thus constituted, organized on Aug. 15, 1894, and appointed as its Chief Engineer Mr. Howard A. Carson, Mem. Am. Soc. C. E., who had been Chief Engineer of the Metropolitan Sewerage Commission since its organization in 1889. Work on the subway was begun on March 28, 1895. Parts of it were opened to public service in September, 1897, and the remainder on Sept. 3, 1898. Including open inclines, it has a total length of 1.8 miles, including 0.76 miles of four-track subway. Among other features, the internal dimensions of the latter call for remark, the structure being 48 ft. wide, by 16.5 ft. high, or 14 ft. from the rail level to the under side of the I-beams. The advantages of these generous dimensions have been emphasized by the adaptability of the entire length of subway to the different conditions involved in its use by the Elevated Railway Company. Trains of four large cars, 8.8 ft. wide, are now regularly run through subways originally intended for the transit of single surface cars.

The cost of the subway, exclusive of equipment, amounting to about $4,380,000, has been borne by the city, which, by contract dated Dec. 7, 1896, granted to the West End Street Railway Company the entire use and occupation of the structure. The lease provides for an annual payment to the city, in quarterly instalments, of a sum equal to 4⅞ per cent. of the ascertained cost of the subway, not exceeding $7,000,000 provided, however, that the compensation to the city for any quarter of a year shall not be less than a sum equivalent to a toll of 5 cents for each passage through the subway of a car not exceeding 25 ft. long, and a proportionately greater charge for cars of greater length, it being understood that any car which enters or passes through the subway, or a portion thereof, in one direction, and then reverses its direction within the subway and makes a round trip (for which facilities are provided) is to be considered as making two passages. Under this contract, the entire equipment of the subway, including tracks, was installed by and at the expense of the lessees. The rental of 4⅞ per cent. on the cost was based upon its sufficiency to meet the annual interest and sinking fund requirements of the 40-year bonds issued for the building of the subway, thus extinguishing the bonds in that period and leaving the structure the unencumbered property of the city at its close.

In 1897 the Legislature sanctioned the lease of the entire undertaking of the West End Street Railway Company to the Boston Elevated Railway Company, and appropriated an additional sum of $500,000, to be applied, with outstanding balances, to the construction of a tunnel or tunnels under the harbor. In the latter respect, some doubt existed whether the Act left it open to the commission to carry the tunnel to a point on the surface at some distance from the subway, using surface tracks to connect with that structure, or whether a "physical connection" between the tunnel and the subway had to be made. The question was decided, as the result of legal proceedings, in 1899, the Commission being restrained from issuing bonds of the city for the construction of a tunnel involving the use of surface tracks. A further attempt was made to restrain the Commission from proceeding with the project, on the ground of the alleged unconstitutionality of the Act. This, however, was disposed of on March 28, 1900, by the Court dismissing the bill based on this contention, and the way was clear for the active prosecution of the work.

A vital feature in the design of the tunnel was dictated by the depth of 40 ft. below mean low water to which it is believed the harbor may ultimately be dredged; it was decided to place the tunnel at such a depth as to secure a cover of not less than 5 ft., and for



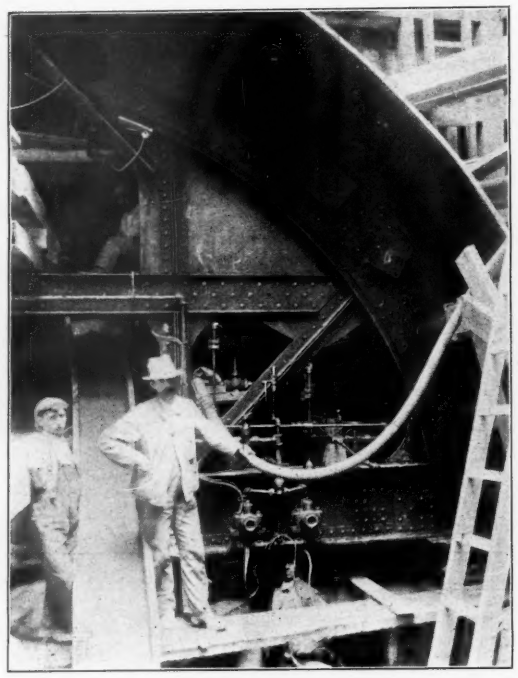
Profile of East Boston Tunnel.

most of its length from 10 to 18 ft. over the arch when this depth of dredging has been attained.

The work already in progress is divided into five principal sections, of which section A embraces the East Boston approach. The contract for this part of the work was awarded on April 24, 1900, to the National Contracting Company, of New York. It includes 140 ft. of open incline, 23 ft. wide, consisting of concrete side walls, faced and capped with granite, and 680 ft. of wide-arch two-track subway, normally 23.3 ft. wide by 18 ft. high, inside, built as a concrete monolith. The gradient of this section is practically 5 per cent. for its whole length, the bottom of the masonry invert at its southwesterly end being about 39 ft. below the street surface. This depth, and the necessity of emerging in Maverick Square, were the controlling factors in preventing an easier gradient at the East Boston end of the tunnel.

The section was excavated in open cut throughout. As in the ordinary subway construction, special attention was paid to securing, so far as practicable, a water-tight structure. Three thicknesses of tarred felt were laid upon the bottom of the excavation, overlapping 6 in., and thoroughly pitched together. When the pitch had sufficiently hardened, the concrete invert was put in, and 6-in. concrete "back-walls" were carried up against the vertical faces of the excavation, the sheeting being temporarily removed, in sections, for this purpose. The back-walls were plastered with rich Portland cement mortar, against which the main walls were built. The concrete arch was allowed to set 12 hours before removing the outer lagging, when the arch was plastered so as to connect with the plaster on the back-walls. As a protection against future excavators, a 4-in. layer of concrete was spread above the plastering of the arch. The centers were left in from 10 to 30 days, according to location. The side walls of the arched portion are 2.5 ft. thick and the arch is 2 ft. thick at the key, exclusive of the back-wall and concrete protection respectively. Nuts and washers were embedded in the masonry, to admit of the use of steel tie-rods, but no tie-rods have as yet been attached to them. So far as practicable, the work was carried on in 12-ft. sections, the operations of laying tarred felt, putting in concrete inverts, walls and arches, etc., closely following one another. It was frequently necessary to keep the work going until 9 p.m., or even later, in order to ensure this continuity of work. Most of the concrete was mixed with a Barber mixer, in the proportions of one part cement to two parts sand, and four parts broken stone.

The contract for Section B, including the entire length of tunnel under the harbor, was awarded in June, 1900, to the Boston Tunnel Construction Company. It is an arched structure for two electric railroad tracks, and the portion under the harbor, 20.5 ft. high by 23.3 ft. wide, has a length of 2,700 ft., not including the lengths under wharves at each side. This length under deep water is one of the distinguishing features of the tunnel, being more than twice as great as that of the tunnel under the Thames at Blackwall, London. The method

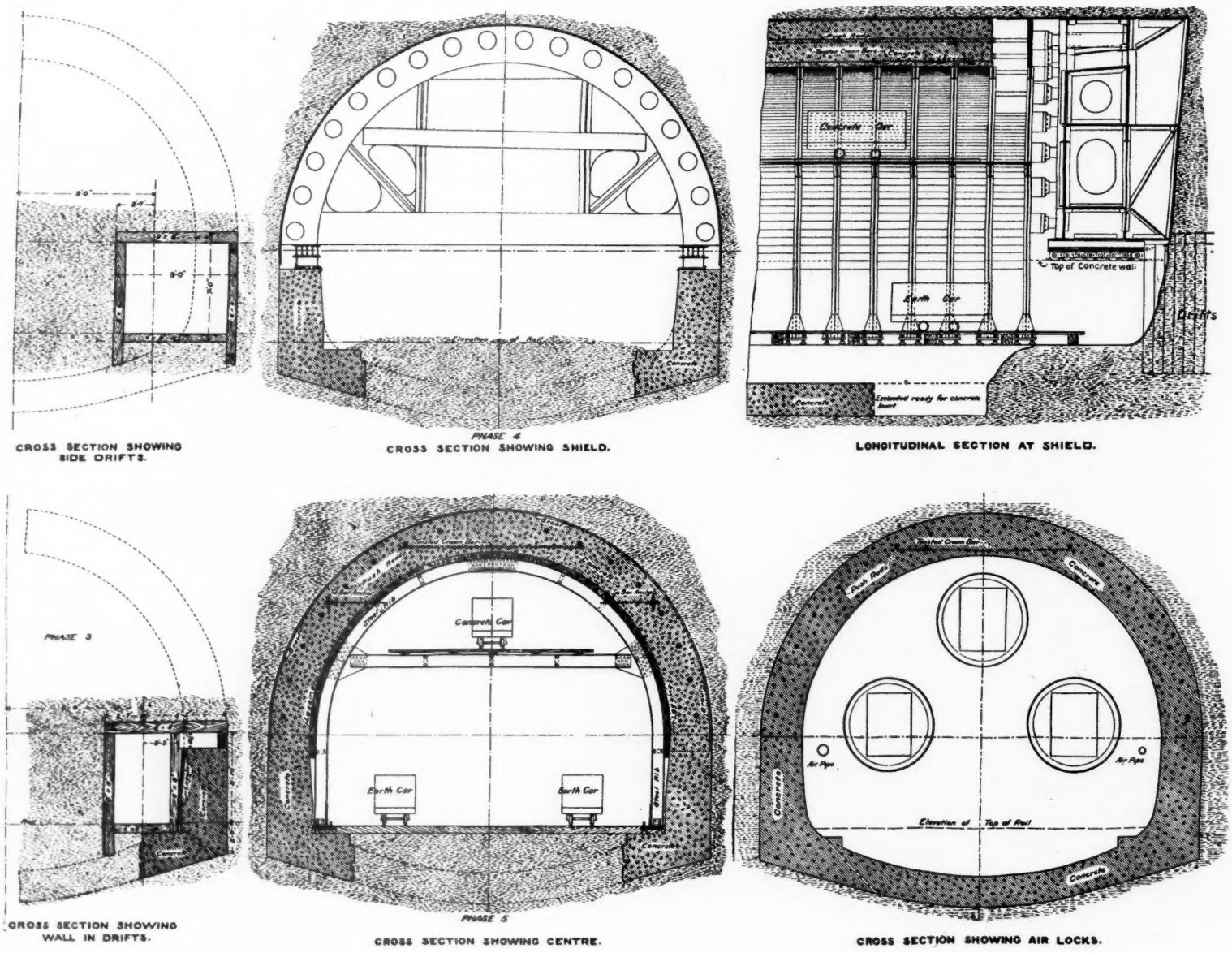


Valves for Operating Shield, East Boston Tunnel.

of construction involves the use of a roof-shield running upon side-walls previously built in small drifts, the bulk of the excavation being performed later, under the protection of the shield. This method follows very closely that adopted in the day-work portion of Section 6 of the subway, in 1896 and 1897, with the important difference that the arch in Section 6 was of brickwork, while the entire cross-section of the East Boston tunnel is of concrete, with arch and side-walls 33 in. thick, and invert 24 in. thick. The decision to use this method on Section 6 was the result of investigations made, at that time, in regard to this class of construction. It was found that a roof-shield running on side-walls had been unsuccessfully tried, in 1892, in the Howard street tunnel of the Baltimore Belt Railroad. A more encouraging example of this method was found in the case of a Paris trunk sewer (*Collecteur de Clichy*), begun in August, 1895, and completed in October, 1896. The shield had an outside width of 23.8 ft., and moved on rollers which in turn rested and moved on longitudinal timbers. The rams which moved it forward re-acted against a series of centers on which the masonry arch was turned. The shield used on Section 6 of the subway was designed by the Engineering Department of the Boston Transit Commission in 1896. It was an arch-like structure, 12 ft. long, with a rise of 8.6 ft. in its outer span of 29.3 ft. Its weight was about 22 tons and its cost amounted to about $6,000.

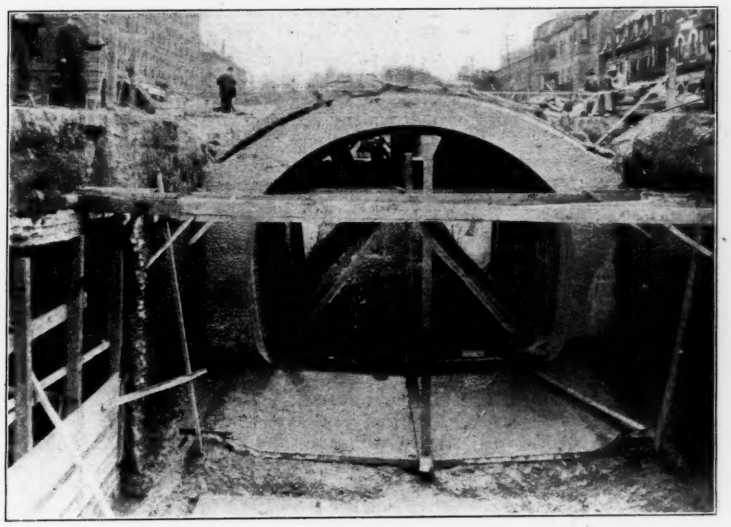
The East Boston tunnel is believed to be the first successful example of walls made of fresh concrete in connection with shield tunnelling. Attempts made in Paris on similar lines were not successful. The contract for the work stipulated that the rear portion of the presses actuating the shield should re-act against heavy lagging or against the properly braced ribs of the centering on which the exterior wall of concrete is built, and provision was also made for the possible use of cast-iron segments, instead of concrete, where deemed necessary by the Engineer. Soon after the contract was signed, the contractors requested that cast-iron be used in the arch, on the ground that it might not be practicable to form arches of fresh concrete in connection with shield work. The request was not acceded to, but a modification was made in the arch, which, according to the contract, was to have been made in two concentric shells, the outer one being constructed first, and coated with rich cement mortar on its interior face before building the inner shell against it. As modified, the arch has been built in a single thick shell instead of two thin ones, and cast-iron push-rods (similar to those used on Section 6 of the subway) were embedded in the arch for the jacks to push against, instead of the re-action taking place against the 6-in. lagging on which the outer shell was to have been built.

A shaft, 34 ft. by 36 ft., was excavated at the East Boston end of the section to the required depth of 42 ft. The concrete invert was then put in, and the side walls within the shaft were built up to within 16 in. of the springing lines of the arch. The tops of these walls thus served as foundations for tracks on which the roof-shield should run. Side drifts, 8 ft. sq., were then begun

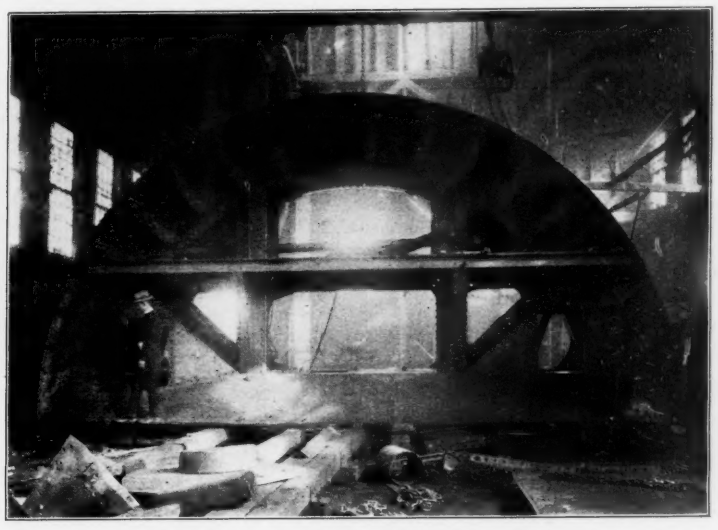


Sectional Views of East Boston Tunnel.

in which to build the side walls in advance of the shield. The outer faces of the drifts are lined with 2-in. planking, supported by 8 in. x 8 in. spruce legs, 2.5 ft. apart on centers, with longitudinal 6 in. x 8 in. timbers at top and bottom. The interior face and top are lined with 8 in. x 8 in. legs placed solidly together. The excavated material is removed to the shaft in wheelbarrows and raised to the surface by a derrick and hoisting engine. The side drifts are usually driven 40 or 50 ft. ahead before the bottom is fully excavated for the concrete wall foundations, which are put in in lengths of 16 to 20 ft. at a time. As soon as the concrete is sufficiently set, a longitudinal 6 in. x 8 in. timber is placed in position beneath the caps overhead and securely supported by means of posts set on the concrete foundation at a distance of 3 ft. from the outer line of the tunnel. These being in position, the outside posts are removed, and the concrete wall is then carried up to the level of the previously completed portions.



Subway at Sumner Street, East Boston.



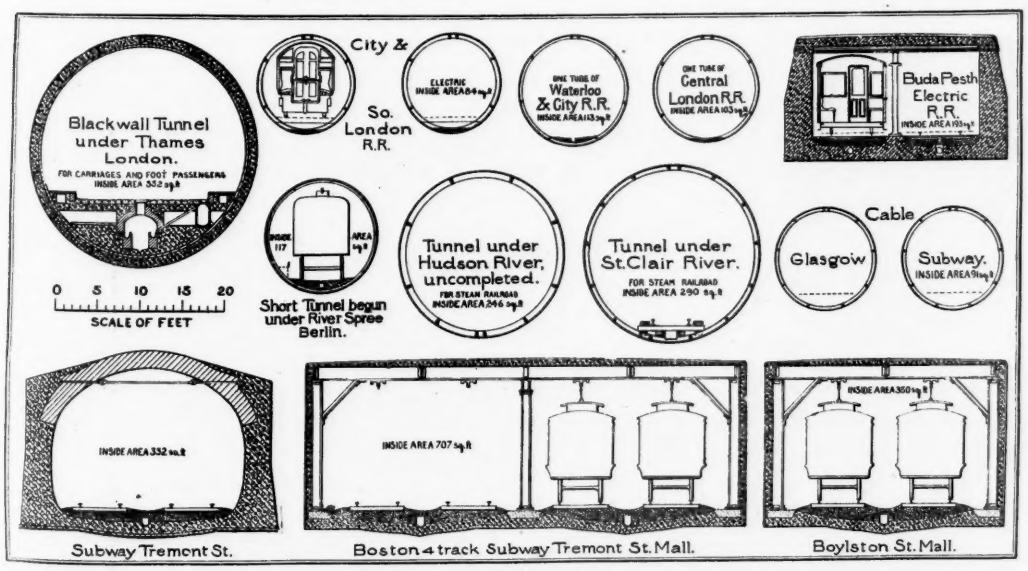
Roof Shield for Section B, East Boston Tunnel.

The roof-shield, 12.5 ft. long, 28.8 ft. in its greatest diameter and weighing 62 tons exclusive of hydraulic jacks and force pumps, was brought to the ground in two sections, and lowered into position for assembling on the top of the side walls in the shaft. The shaft had been specially timbered with a view to the admission of the shield. When the shield was assembled and riveted, 16 hydraulic jacks, each having a capacity of 75 tons, were placed in the openings prepared for them and connected with the pumps in the shield. The shield rests on 16 live iron rollers (eight on each side) which in turn rest upon steel plates placed on top of the side walls. These plates are flanged, so as to act as guides to the shield when moving. The rollers are 8 in. in diameter and 16 in. long. After the shield had been pushed forward for the first length of 2.5 ft., the concrete arch was turned over that length, and 16 lines of cast-iron push-rods, each 3¼ in. diameter and 30 in. long, were embedded in the material of the arch to receive the thrust of the jacks at the next movement. In building the arch, curved steel ribs, made of 10-in. channels, and set 30 in. apart, are used as centering. Four-in. lagging, cut to radial lines, is placed on the ribs as the concrete is put in, and wooden bulk-heads, attached to the plungers of the hydraulic jacks, help to confine the fresh concrete. The final keying-up of the arch is effected through two 13-in. holes in the rear girder, at the top of the shield. Curved sheet-iron troughs extend from there to the top of the arch, and concrete thrown into them is pushed by properly shaped hand rammers into the unfilled space at the crown of the arch.

These contrivances have successfully overcome the anticipated difficulty of dealing with such an unstable material as fresh concrete under the conditions met with in this work. The advancing tail-piece of the shield leaves a vacant space between the earth and the completed section of arch; this is filled with grout, composed of from one to three parts of fine sand to one part Portland cement, forced upward by pumps through 2-in. vertical pipes placed at the crown of each section of arch. About 30 cu. ft. of grout is required for each 2½ ft. length of arch.

The excavation of the earth core is carried on simultaneously with the building of the arch. The invert is excavated and concreted in 10-ft. sections at a distance of 20 to 30 ft. in the rear of the shield, while the side-drifts and walls are kept uniformly about 100 ft. in advance of it. Small cars, holding about a cubic yard each, are used for transporting materials between the shaft and the headings, and three main lines of track for the cars are maintained beyond the air-locks. Two of these are on the sides of the lower part of the tunnel and are used for cars loaded with excavated earth or with concrete. The third track is in the center, near the top of the tunnel, and is for taking in cars of concrete used in constructing the upper part of the arch.

When the shield had been advanced about 230 ft., work was suspended for two weeks to put in the three boiler-iron air-locks. These are each 27 ft. long by 6 ft. in diameter, with a tight-fitting door, 49 in. high and 39 in. wide, at each end. They are placed about 100 ft. from the shaft, the two in the sides being about 6 ft. above the invert, and the middle one about 13½ ft. above it. The two lower locks are used for working purposes, and the upper middle lock for emergency only. A dome-shaped bulkhead of brick masonry, convex on the side of the air-pressure, 3 ft. thick and reinforced with angle-iron hoops, encircles the inner end of the locks.



Relative Sizes of Various Subways.

As soon as compressed air was used, the temperature in the tunnel rose to 80 deg. F. in the upper part of the shield. Near the locks, on the air-pressure side, it is about 95 deg., as compared with 74 deg. beneath the shield and in the drifts. Under ordinary conditions, the amount of carbonic acid gas in the air of the tunnel varies from 1.2 to 5.7 parts to 1,000 parts of air, with a mean of about three parts.

The air-pressure is usually 22 lbs. per sq. in. above that of the atmosphere, increasing to 25 lbs. when unusually soft clay is met, or in passing through strata containing sand, gravel and water. Air escaping through the ground to the surface of the street is very noticeable in wet weather, when bubbles form on the pavement.

The amount of free air per hour per man pumped into the tunnel has ranged from 650 to 1,500 cu. ft., averaging about a thousand. Very few cases of "caisson disease" have been reported.

Special provision is made for the permanent ventilation of the harbor portion of the tunnel, which is nearly level for a length of 1,350 ft. A segmental duct of 45 sq. ft. area is formed in the top of the tunnel, communicating with it, near the middle of the harbor, by a door. The shore ends of the duct will open into ventilating chambers through which the air can be drawn out by fans, thus ensuring a constant circulation of air within the tunnel and the ducts.

The shield has operated mainly in blue clay, weighing about 120 lbs. per cu. ft. At one point, the clay was softer than usual and allowed the drift to settle from 4 to 12 in. Some silt and gravel have also been encountered, as well as boulder clay. The total length of tunnel excavated on Section B, to date, amounts to about 3,900 ft., giving an average rate of progress, since the commencement of the section, of about 29 ft. per week. The present rate of progress is about 51 ft. per week.

The Ingersoll-Sergeant Drill Company, of New York, has supplied three of the air-compressors used on the work. Of these, a high-pressure compressor, with a capacity of 700 cu. ft. of free air per minute, furnishes power for the machinery, the usual pressure being 125 lbs. per sq. in. Two others, having a capacity of 1,040 and 530 cu. ft. per minute respectively, with a normal pressure of 18 lbs., are used either for furnishing compressed air in which to work or hold in reserve. A Rand high-pressure compressor, equal to 250 cu. ft. of free air per minute, has been added to the original plant, which also includes three 100 h.p. boilers, three air-receivers, one Barber cubical concrete-mixer and engine, three hoisting engines, one elevator, 40 small cars, and two small steam-pumps.

The work on the remaining State street sections, between Atlantic avenue and the Old State House, is well advanced, a roof-shield being employed on Section C, immediately adjoining the work described above. Work has also been done in reinforcing the foundations of the heavy buildings at the junction of Court and Washington streets, in preparation for an extension of the tunnel to Scollay Square, where it will be carried under the existing subway station, with due provision for access. In the same vicinity, communication will also be established with an important addition to the Transit Commission's work, to be built under the authority of an Act passed by the Legislature of 1902 and subsequently ratified by the voters of the city. This provides for the building, within a zone specified in the Act, of a two-track subway or tunnel for elevated cars or trains, and of a similar structure for surface cars, with the proviso that on the completion of the former the elevated cars and trains shall cease to run in the existing subways, these, as already stated, having been originally designed for the exclusive use of surface cars. The new tunnels will practically parallel the original main line of subway, so as to maintain and add to the present facilities for through transit between the northerly and southerly sections of the city.

Test Departments.

BY C. W. GENNET, JR.

A department of tests is an essential feature of intelligent railroading. It aims toward safety and economy—two factors closely related and largely dependent on each other. For example, with cast iron wheels, the object sought is to get a quality from which can be obtained the greatest service for minimum cost, and which is at the same time wholly able to meet the requirements of that service. The specifications point out what is desirable to meet these conditions, and it remains to cover the rest of the case by maintaining the standard set for a safe economical wheel.

Railroad men who do not regard quality nowadays are few. The time was when a piece of iron of the right size that "looked" good was considered fit for almost any boiler use, but specifications have followed scientific dis-

covery and the purchaser who does not buy with regard to a certain standard is exposed to trouble. The test department should be in a sense the connecting link between what is desired and what is obtained. The case is on record of a reorganized road which sent an inspector to an iron mill to pass on a shipment of iron. The iron merchant with a flourish waved off the inspector without admitting him to the mill. The incident was, of course, reported to the Superintendent of Tests, who advised the head operating official of the circumstances, adding that one fault of the road was that a lot of poor material had been unloaded on it, and straightway came an order to the Purchasing Agent to stop dealing with this iron merchant until he was willing to meet the requirements of the specifications by allowing the iron to be tested. This is an example of how the rut is reached and how it may be avoided.

It certainly must not be assumed that manufacturers are an untrustworthy lot, whose sole aim is to fleece corporations, and that therefore the test department is simply an organization to prevent fraud. Conditions are quite the opposite, and the progressive manufacturer is always willing to meet the requirements of the specifications and to allow his product to undergo any test prescribed for the purpose of satisfying the purchaser. But his product, though its making is carefully conducted, is unfortunately often open to numerous irregularities which influence its quality, and until thoroughly tested by the purchaser leaves the latter in doubt as to its ultimate capability of acceptance.

Questions involving direct economy of operation can best be settled by the test department, which acting largely as a disinterested party makes the necessary comparative tests and arrives at the conclusions governing the use of new appliances, apparatus, etc. The question was once raised by a road, buying for the same price per ton from some 20 odd coal mines, whether any economy would accrue by using coal from the few which might prove to afford the best quality. The test department after a thorough investigation reported a maximum difference of about 15 per cent. in the amount of coal required from the various mines to do the same amount of work.

The test department should have for its object—

1st. Absolute power with reference to specifications which includes the preparation of specifications governing the various articles of purchase and the business of maintaining the standards set through a system of inspections and reports.

2nd. Investigation of appliances, comparative testing, and, in short, the study of any subject that may be referred to this department as affording opportunity for better service or possible economy.

With these objects in view the organization can best be maintained when the test department, which has inspectors and chemists, reports directly to the general manager, and is quite independent of the motive power, maintenance of way and purchasing departments. The advantages of such an organization are obvious. On matters of general operation, the test department reports to and receives orders from the General Manager, and on matters relating to the various divisions of operation, as motive power and maintenance of way, it acts in conjunction with these two departments; all three of which are necessarily linked with the purchasing department. The test department will be made up of the chemist and inspectors, as many of each with proper clerical force as are necessary to handle the work, under the direction of a Superintendent or Engineer of Tests.

The inspectors can do their maximum work when each is well versed in all of the particulars of inspections required to be handled. If such is the case it will be found possible to handle the work not only quicker but with less movement from point to point, which will help to keep down the expenses of this department. But to have several inspectors on the same order at different times is in a measure unsatisfactory; and wherever possible the same inspector should handle continually the work of one mill or factory, which will insure the manufacturer against the discrepancies liable to result from the different opinions based on the same principle, but likely to be somewhat confusing.

Where the railroad system is a large one and material is purchased in widely separated parts of the country the work can best be attended to by stationing inspectors at various points, central to a large proportion of the work in hand, and which can be made headquarters for a certain territory. Thus several roads find it expedient to maintain one or more inspectors each at Pittsburg, who can handle the work originating from the large territory around that city with a great saving in time and expenses of travel. The use of annual transportation passes by the various inspectors will result in reducing to a minimum the transportation expenses which tend to be the chief source of expense in the operation of this department.

Orders for bridges usually require almost constant attendance; and the nature and usual extent of bridge inspections is such as to be most satisfactorily regulated if sufficient inspectors are employed to permit of stationing them at the works where bridge orders are under way and having them attend solely to this business. On the other hand, with rails and other material the best results can be obtained, as pointed out, by moving the inspectors about as little as possible, but employing those whose resources enable them to handle any class of material.

The organization besides the inspectors should consist of a sufficient office force to keep up the clerical work, and it is to be understood that a sufficient number of inspectors are to be kept at the office or detailed to take care of the necessary tests and special work that may be undertaken. The position of the chemist and his assistants in the laboratory is quite obvious, and it is unnecessary to go into detail concerning it in this article.

It has been said that the specification should originate in the test department. This statement is subject to some broadening, for while it is fundamental that the Superintendent or Engineer of Tests should be one thoroughly acquainted with the work, it is right that not only his ideas but those of the other departments, to whom the specific material goes, should be incorporated in the requirements. So the specifications governing locomotive and car material should be composed in conjunction with motive power and rolling stock departments, while those governing rails, bridge and track material should be made up with the help of the maintenance of way department. Specifications thus prepared contain the individual ideas of those directly concerned together with the practical methods of obtaining satisfaction as to the quality desired. It would not be impossible to provide conditions in them which would unthinkingly affect the purchasing department's position or authority, and to this end before the specifications are finally decided upon, they should be submitted to the purchasing department for approval or suggestions. Frequently, too, it is desirable to obtain the opinions on various specifications of the leading manufacturers, particularly those who do a sufficient business with the road to justify the elimination of conditions liable to affect their position either in point of product or its valuation.

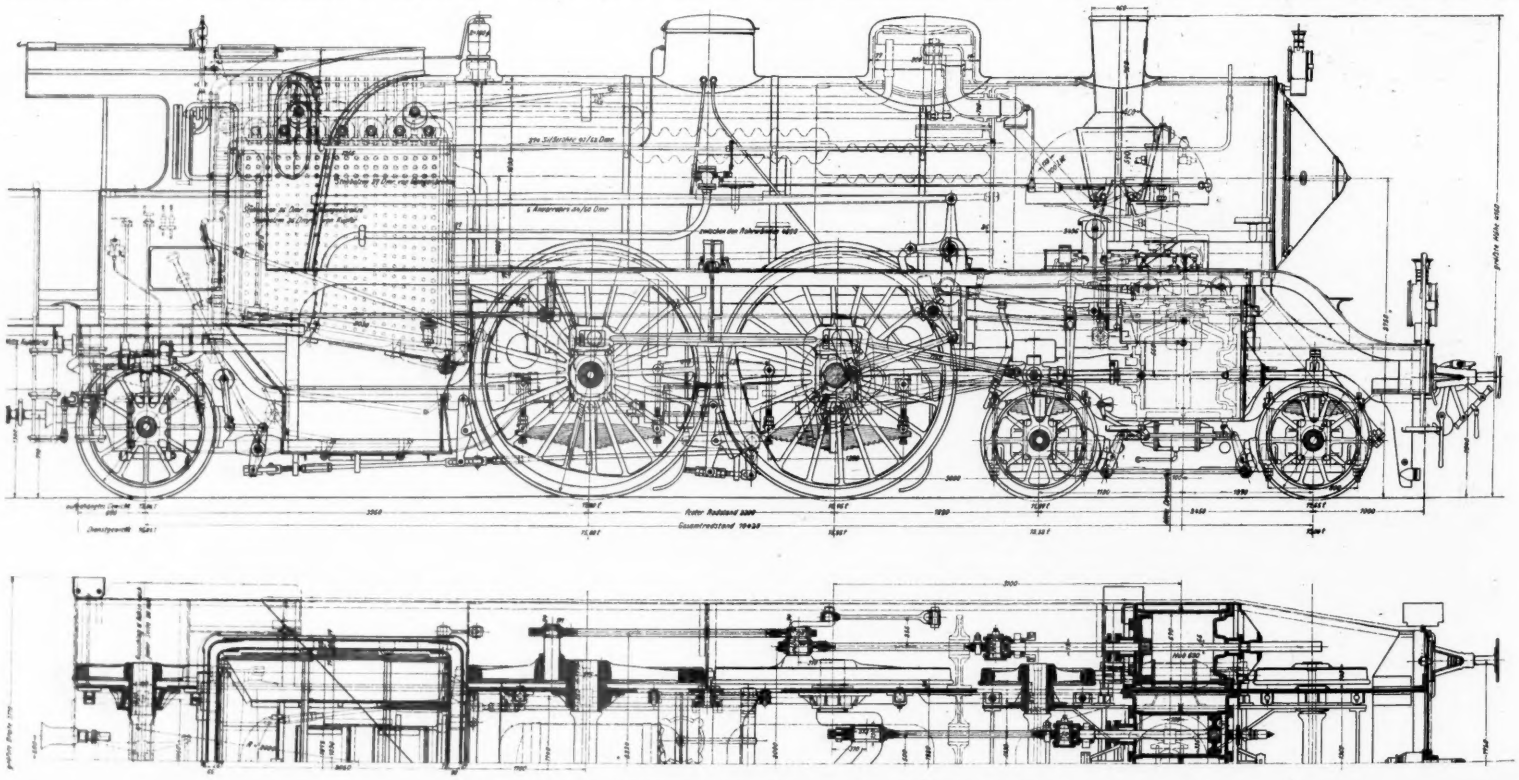
An important clause in all the specifications is that requiring manufacturers to give due and definite notice in advance to the test department when the material is ready to be shipped, it being, of course, assumed that most of the materials are to be tested and inspected previous to shipment from the mill or factory to the destination at the company's storehouse or shops. This will be found to be the most expedient and satisfactory course for various reasons. The storekeepers will know at once that any material they receive is quite acceptable for use; the manufacturers will appreciate it; and possibly the cost of the material will be lessened if this course is pursued, while, on the whole, it is better to accept or reject at the factory. The nature of some materials or articles, however, may demand that they be sampled and tested after arrival at destination, and occasions may arise when there will be a saving in time on certain orders by following this procedure so that the rule should be flexible.

The real business of the department is to maintain the standards set by the specifications, and it is necessary that the department be furnished promptly with copies of the contracts and orders covering the purchase of equipment. Thus if a contract is let for bridges, cars or locomotives, the department on receiving notice will ask the contractors to furnish a copy of such orders as they issue, the material of which is to be subject to the railroad's inspection and specifications. The purchasing agent will send to the department a copy of such orders as he issues for materials and articles subject to specifications. In this manner the department is always cognizant of the work in hand and can make the necessary arrangements for taking prompt care of the business. The work as fast as handled can be checked off on the orders and the inspectors can also be advised of such terms of the orders as are necessary for their complete understanding.

As an illustration of how the work can best be attended to, assume that the railroad company has contracted with a certain locomotive works for a number of engines. When the contract is received by the test department, the attention of the contractors had best be called to the fact that as certain materials entering into the construction of these engines are to be according to the company's specifications and inspection, they will issue their orders accordingly, and a request may be added asking that a copy of such orders be sent as promptly as issued to the test department. In due time copies of these orders will be received and arrangements made for handling the work. It may be found that a large amount of the material will originate from one district or locality, and it is not unlikely that the contractors will have asked for delivery of the various materials at about the same time, so that it will be found expedient for the test department to station an inspector at some point convenient to this locality. A request for an inspection then comes from a manufacturer, and it is promptly done.

The inspector should make a daily report of the work done, and he should add such information as to future work as may be of value. It may not always be possible for him to promptly report in a formal way the results of the tests, but as soon as may be, this report should be made. It may be well to have the inspector supplied with blank forms which he can fill out specifying the exact quantity and nature of the material he has accepted. One of these may be given to the manufacturer, and it then constitutes an authority for him to make the shipment, while a copy of it is to be sent to the department, which will in turn notify the receiving party at destination that this stated material is acceptable for use in the company's work.

As soon as possible a formal report of the inspection



Four-Cylinder Compound Locomotive—Baden State Railroads.

should be made. To cover this, it is well to have forms of report blanks which can be ruled up and headed as necessary in order to give a complete description of the results of the test and inspection. These should be kept on file in such manner as to permit of being readily referred to. For example, a wheel breaks in service and the maker's name and the number of the wheel being known, if the reports are correctly kept, it will be found an easy matter to ascertain exactly what occurred when the particular lot of wheels of the date which includes the broken wheel was tested.

By co-operation with the motive power department records giving the final location of individual pieces of material bearing a serial number may be kept, and on question always liable to be raised when a failure occurs, these records will be found of much value as the means of affording an exact synopsis of just what the result was when the particular piece was tested and accepted.

Records setting forth the result obtained at mills making the same class of material can be made to serve as a guide for future purchase. Thus, if iron is obtained from several different mills and accurate results of the test of each are systematically tabulated, it may be eventually found that that from a particular mill is most acceptable for future purchase. Questions like this are not infrequently answered with much benefit to the purchasing agent, and a new light may be easily thrown on the time-work subject of how to arrive at economy.

It may happen that an inspection cannot be made on the date set. The manufacturer can be authorized to make the tests prescribed and ship under his own responsibility; or authority may be given to ship with the understanding that the samples of material will be tested upon its arrival at destination. Both of these methods are unsatisfactory, and should be used only as a last resort, and with the past records of the makers well in mind.

Four Cylinder Compounds in Europe.

BY REGINALD GORDON.

An account of the latest practice in the construction of four-cylinder compound locomotives has been published recently by Herr von Borries in the *Journal of the Society of German Engineers*, in which the author gives descriptions and principal dimensions of engines of that kind built during the last two years. Of the nine locomotives described four are ten wheel and five are the Atlantic-type.

The engine* built last year for the Plant System by the Baldwin Locomotive Works is the most powerful of the ten-wheelers, and more nearly like the European engines than any other that could have been selected for comparison.

The four-cylinder compound is growing in favor with the French and German locomotive designers, particularly on account of the uniform distribution of the forces to the individual cranks, as in the de Glehn, von Borries and Gölsdorf systems. For passenger service, the Atlantic-type bids fair to become popular in Europe. It is also noticeable that European engineers have taken advantage of this type to obtain a wide fire-box and grate. The engine for the State railroads of Baden has a grate area of about 42 sq. ft. In this connection, it is interesting to compare the ratio between grate area and tube heating surface of some recent locomotives built here and abroad. (See Table 1.) Table 2 gives the weight and principal dimensions of the engines described in von Borries' article. The first one, built at Chemnitz by the Saxon Machine Works for the Saxon State railroads, was the first four-cylinder compound of the de Glehn type used on the German roads, and was exhibited at Paris in 1900. The

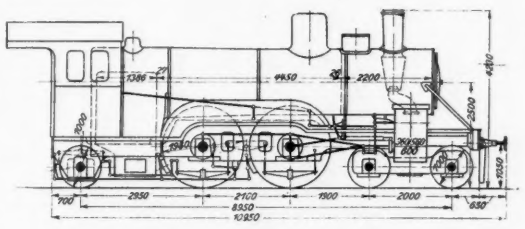


Fig. 1—Four-Cylinder Compound—Prussian State Railroads.

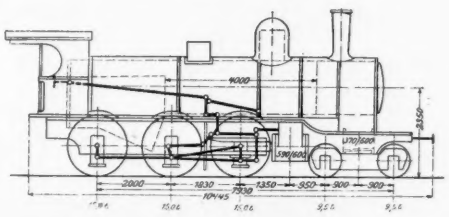


Fig. 2—Ten Wheeler for the Gothard Railroad,

high pressure cylinders are outside the frames, back of the forward truck and are connected to the rear drivers, while the low pressure cylinders are under the smoke box and connected to the forward drivers through the medium of a cranked axle. The fire box, lying between the frames, is rather small. All wheels are braked. The Lindner starting device for admitting live steam to the low pressure cylinders is used. The ratio of the volume of the high to the low pressure cylinder is 1 : 2.54.

The Atlantic-type engine* given in column 2 was built for the Austrian State railroads. The cylinder volume ratio is 1 to 2.9, and the fire box is above the frames with 38 sq. ft. of grate surface. Column 3 refers to a von Borries compound for the Prussian State railroads, built at Linden last year, and shown in outline in Fig. 1.

Columns 3 and 4 refer to a von Borries and a de Glehn Atlantic-type engine respectively. The size and power of these engines are about the same. The Prussian engine is very similar in design and in arrangement of high and low pressure cylinders to the Austrian engine mentioned in the preceding column.

The de Glehn compound of the Northern of France was described in the *Railroad Gazette*, September 28, 1900, and October 10, 1902.

The locomotive for the State railroads of Baden, shown herewith, is interesting as one of the latest developments of German practice. Its general features are shown by the illustration. Although the fire box is placed above the frames, the trailing axle is back of the boiler. The trailing axle is 12 ft. 11½ in. back of the center of the rear driving wheel. This makes an unusually long wheel base, the total being 34 ft. 2¼ in. The truck wheels are 39 in., and the trailing wheels 47¼ in. in diameter. Every wheel of both engine and tender is braked. It will be noticed that the main rods of all four cylinders are connected to the forward axle, and the Walschaert valve gear is used. The boiler is set high, the center being 9 ft. above the rails, and a sand dome with pneumatic sanding device is placed on top of it, these two features closely resembling American practice. The front of the smoke box is cone-shaped, and the front of the cab is brought around to meet the surface of the boiler in a smooth curve. The pivot of the front truck is about 4 in. back of the center to give greater ease in curving. The tender is mounted on two four-wheel trucks, with wheels 39⅝ in. in diameter and has a capacity of 5,284 gallons of water and 6½ tons of coal.

The four cylinders are side by side under the smoke box, the high pressure being inside, the low pressure outside the frames. The high pressure cylinders have piston valves with cast iron rings and inside admission, while the low pressure cylinders have slide valves. The low pressure piston rods are extended through the front cylinder heads. By means of a special starting valve, live steam can be admitted to the low pressure cylinders. Relief valves are attached to the intermediate receiver, and open at a pressure of 132 lbs. per sq. in. The cylinder volume ratio is 1 : 2.88.

The other locomotives given in the table are ten-wheelers. Fig. 2 shows a ten-wheeler for the Gothard railroad. In the last column of Table 2 are given the particulars of an engine familiar to the readers of the *Railroad Gazette*, as it was illustrated in the issue of February 28, 1902, and attracted a good deal of attention at the time it was built.

*See *Railroad Gazette*, Feb. 28, 1902.

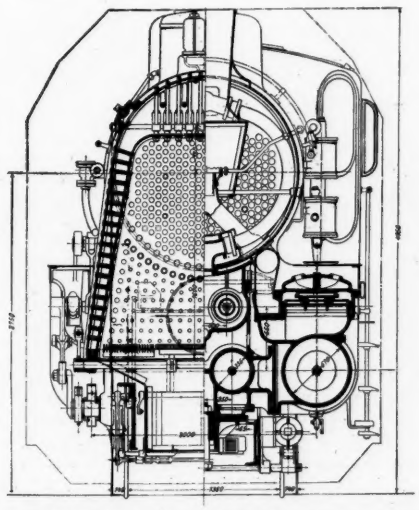
Table 1.—Ratio Between Grate Area and Tube Heating Surface.

Railroad.	Type of loco.	Ratio.
Baden State	Atlantic	54
Austrian State	"	59
Saxon State	"	69
Prussian State	"	60
N. Y. Central	"	66
Vandalia	"	61
Lake Shore	Prairie	65
Chesapeake & Ohio	"	71

TABLE 2.—WEIGHTS AND DIMENSIONS OF FOUR-CYLINDER COMPOUND LOCOMOTIVES.

System of compounding	de Glehn	Gölsdorf	von Borries	de Glehn	von Borries	de Glehn	de Glehn	von Borries	Vauclain
Railroad	Saxon State	Austrian State	Prussian State	Northern of France	Baden State	Bavarian State	Gothard	Austro-Hungarian State	Plant System
Builders	Saxon Wks., Chemnitz	Prague Wks.	Hanover Mch. Wks., Linden	Alsacian Works, Belfort	J. A. Maffei, Munich	Maffei, Munich,	Winterthur Works		Baldwin Loco. Works
Year built	1900	1901	1902	1900	1902	1896	1900	1902	1902
H. P. cylinders, diameter, in.	13¾	13¾	14⅛	13⅜	13 3/16	15	13¾	13¾	15
L. P. cylinders, diameter, in.	21¼	23⅝	22	22	22 7/16	24	23¼	22⅞	25
Stroke of pistons, in.	24¾	26¾	23⅝	25 3/16	24⅜	25 3/16	23⅝	25⅝	26
Diameter of driving wheels, in.	78	84¼	78	80 5/16	82⅝	73⅝	63	70⅞	73
Heating surface of tubes, sq. ft.	1775	2449	1743	2,271	2,260	1,689	1,186	1,808	2,665
Grate surface, sq. ft.	25.8	38	29	29	41.9	27.9	25.8	33.4	27.25
Boiler pressure, lbs. per sq. in.	220½	220½	205¾	227½	235	205¾	220½	191	200
Boiler diameter, in.	57	64¾	56⅝	57⅜	63	....	59	57	62
Number of tubes	228	329	243	126*	279	227	244	231	341
Diameter of tubes, in.	2	2	2	2¾	2	2	2	2	2
Length of tubes, ft. and in.	15 5	13 1½	14 7¼	13 9⅜	15 9	14 1	13 1½	15 1	15 0
Weight on driving wheels, lbs.	70,700	64,000	67,180	71,825	70,500	102,760	99,450	92,820	127,010
Tot. weight in working order, lbs.	143,600	150,940	133,040	143,650	163,760	144,100	141,440	143,430	176,510

*"Serve" tubes.



Four-Cylinder Compound—Baden State Railroads.

*See *Railroad Gazette*, Feb. 28, 1902.

Civilizing Siberia.

The Commission which has charge of the construction of the Siberian Railroad and the development of the country contributory to it, the chairman of which is the Czar himself, reviewed its work for the past 10 years at a meeting last January. The report of this describes not only the construction of the railroad, but of many auxiliary enterprises which the world has heard less of. The railroad in Russia, except that around the south end of Lake Baikal, was regarded as completed. The latter, which will be 162 miles long, is estimated to cost $155,000 per mile, and the track is laid on 36 miles of it; but the work on the remainder is so heavy that it will not be completed till 1905. The expenditure for the Lake Baikal car ferry, which has been nearly a failure in winter, has been $3,400,000.

Among the auxiliary enterprises have been the improvement of five rivers crossed or touched by the railroad, and the establishment of steamboat navigation on some of them to carry materials for the railroad. The greatest of these enterprises, however, has been the facilitating of immigration and the selection and distribution of lands for the immigrants. About 25,000,000 acres of land has been surveyed. That the land fit for cultivation is but a small part of the immense area made accessible by the railroad and the rivers which it crosses is indicated by the fact that immense drainage works have been undertaken to reclaim marshy districts, and elsewhere irrigation works for semi-arid regions.

The number of settlers who have taken lands in Siberia in the last 10 years is reported to be 611,494, which is very much less than has been frequently reported. These immigrants have been aided in every way. Their fares were merely nominal; shelters were provided at the chief stations where they disembarked, and elsewhere on the way to their lands (frequently far distant from the railroad); 81 dispensaries with physicians were established; loans were made for their support till they could earn on produce something, limited to $75 per family in the Amoor country and to $50 west of Lake Baikal. These loans are to be repaid in five yearly instalments, beginning five years after they are made. Warehouses were established with stocks of farm tools, seed grain and other supplies, sold to settlers at moderate prices; these stores purchased and imported grain which was sold at a low price to settlers in 1901, when the crops failed; supplies of timber were brought from the government forests in western Siberia and sold at cost to settlers, to enable them to build houses, instead of living in dugouts; 190 churches and 184 schools were established at stations and other settlements.

Another important work of the Commission has been an economic survey, to ascertain the resources of the country which may profitably be developed. In two places on the railroad coal has been found which is used on locomotives and for the Lake Baikal ferry. Search for gold mines has resulted in finding new ones, chiefly on or near the Pacific coast, at an immense distance from the railroad. Explorations at the mouths of the Obi and Yenisei Rivers have shown that ocean steamers can ascend the latter for a distance of 1,000 miles. (It is very difficult and often impossible to enter these streams from the Arctic, however.)

Proposed Design of Locomotive Valves for High Speeds.

BY J. V. N. CHENEY.

Much has been said and written on the above subject. Some advocate long valve travel, some short valve travel. Others advocate small lead, some more, others none at all at full stroke, and yet I can find no great difference in the general design, or layout, from what we had 20 years ago. We had fast trains then, but had small engines to haul them, and considering the lower steam pressures then used, the small engine did good work. The valve motion has not materially changed since then, and we use the old style cylinder which our grandfathers used, put up the boiler pressure 50 to 75 lbs. and get a little more speed than he did.

In modern stationary practice much has been accomplished in the way of reducing the clearance, but what has

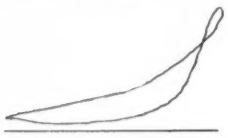


Fig. 1.

Fig. 2.

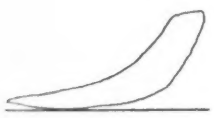


Fig. 3.

Fig. 4.

been done in this direction in locomotive practice? In a few cases piston valves are used which reduce the clearance to a small extent, if at all, but there are not many piston valves used, compared with the number of locomotives running and being built. In good stationary practice, the clearance is frequently reduced to from 1 to 3 per cent. Why is this not possible with the locomotive? There is room for radical reform in cylinder design, for high speed work, and when we consider the power lost in driving the engine itself at a high rate of speed, why not turn our attention to a means of reducing the disturbing forces to a minimum?

I have for several years advocated the use of separate exhaust valves of the semi-rotary type, and piston valves having outside admission for the admission of the steam. The cylinder ports could be at the ends of the cylinders, making a short, direct admission instead of being in the center, through which the steam is led by twists and turns to the ends of the cylinders, then having fulfilled its mission of moving the piston in one direction, it must come back the same route to the extreme center of the cylinder, where it is shot down into the exhaust cavity, then up through the contracted nozzle, doing its last duty of urging the fire. To be sure, this last duty is necessary, as with the comparatively small grate area in general use we require a strong draft.

It is reasonable to say that a gain in economy of 15 or 20 per cent. might be secured by such an arrangement of valves and ports, quite a gain being due to the smaller clearance obtained by a shorter and more direct admission port. Again, the exhaust ports are also shorter and more direct, and being controlled by separate valves, a full and constant port opening can be secured, thus reducing the back pressure to a minimum. The exhaust valves could be controlled by the admission valve gear to avoid undue complication. Such an arrangement would be ideal for high speed work. The increased efficiency being more than enough to pay for the extra cost of cylinder construction, a cylinder, and valves built on these lines, should produce an indicator diagram bordering very closely on the theoretical, as there would be very little friction in the short ports, and if they are ample, the steam line of the diagram should hold up to the point of cut off. Again, the exhaust valves can be adjusted to give a constant compression, avoiding the excessive compression obtained with the single valve, which at times rises above the boiler pressure.

All valves should be direct connected, thus doing away with the rocker, where the design of the engine will permit. The proposed arrangement could be better used with the "Columbia" or "Prairie" types; or for heavy freight service the 2-8. This arrangement would not be so easily applied to the 4-4 or 4-6 types. The admission valves should have long travel, giving a quick, sharp movement, and should be set line and line at full stroke, which should not give an excessive lead at short cut offs, and high speeds. Separate exhaust valves can be adjusted to give the required compression, and, as before stated, a full port opening can be secured, thereby reducing the back pressure, and the exhaust steam is not permitted to pass back through the steam chest, taking useful heat from the live steam. This arrangement would be especially adapted to the cross compound locomotive, which, by reason of its large low pressure cylinder requires a large exhaust opening.

A contributor to *Locomotive Engineering* asks the question, Does running with a full throttle flatten ties? He answers it by saying yes, and especially at high speeds, and short cut offs. He says flat spots are caused by excessive back pressure at short cut offs, an unavoidable feature with the single valve, and especially with inside lap. Increase the cut off, and ease off the throttle and see what a difference it makes in the riding of the engine. Cut out the inside lap, making it negative, and the same result will ensue. But there is a limit to this, and no matter what is done in this direction, a restricted port (exhaust) opening is the natural outcome of short cut off with the single valve. He does not say anything about the effect of compression on the working of the engine, but it seems to me this is also an important factor. Take for instance an indicator diagram like Fig. 1. This shows excessive compression and the curve is carried above the boiler pressure. The area of a 20 in. cylinder is 314.16 sq. in., and with a pressure of 200 lbs. the total pressure on the piston is 62,832 lbs. at or near the end of the stroke.

Is it any wonder our engines ride hard, and tires flatten? Try the suggestion of the contributor and we have a diagram like Fig. 2, in which the boiler pressure is not reached during compression, but if it makes a better riding engine, very well and good. Again, drop the reverse lever down a little more and a diagram like Fig. 3 is obtained—a still further decrease in initial pressure, by further closing of throttle, of course, but a pronounced cut off, and still the same old excessive compression. Reducing the boiler pressure would have been the proper thing to do, but it is not convenient to do this, nor economical.

In conclusion, it seems to me that with the proposed arrangement it would be possible to obtain a diagram like Fig. 4 at a high speed, and full throttle, and the compression would be constant at all speeds.

An Asbestos Dust Guard.

The dust guard shown in the accompanying illustrations combines some features not met with in any of the numerous forms of wooden guards. It is made of asbestos, pressed solid, and will not disintegrate by coming in contact with oil. The nature of the material renders it practically indestructible under the action of heat. Unlike wood or fiber, it will not absorb oil and swell in the box, nor will it warp from moisture. The bearing on the axle soon becomes very smooth and practically no wear takes place.

Fig. 1 shows the solid form and Fig. 2 the adjustable for min which the guard is made in two halves, the joint having a lap of about one inch. Fitted in a groove in

Fig. 1.

Fig. 2.

the edge and passing completely around both parts is a single heavy wire, tempered, to act as an adjusting spring. It extends above the top edge at the corners, ¾ in., and is brought in at the center and both ends hooked into small holes formed into the asbestos. In this way the two parts cannot be separated since the axle hole may only be elongated ¾ in. and the lap is 1 in. deep.

When once placed in the box, one of these guards will last the life of the journal. They are simple and inexpensive and are meeting with marked success in service. The Franklin Manufacturing Co., Franklin, Pa., is the maker.

American Ownership of Trans-Atlantic Steamships.

The ownership of trans-Atlantic steamers, before and after the formation of the shipping "combine," shows a surprising proportion of American owned vessels, in view of the fact that the American flag is little represented (only six ships) in the trans-Atlantic steam trade. The ships are classified by speed and tonnage. Of the twin-screw steamers of the world with over 19 knots speed and 7,000 tons gross tonnage there were:

	Before the Deal.	After the Deal.
British	5	2
American	4	7
German	8	8
French	4	4
Russian	2	2

Of all twin-screw steamers of 15 to 19 knots and over 4,000 tons there were:

	Before the Deal.	After the Deal.
British	45	34
American	12	28
German	15	15
French	5	5
Russian	4	4
Japanese	3	3
Danish	1	1
Italian	1	1
Dutch	5	None.

An analysis of the respective merits of the British, American and German boats, as described in the previous list, gives the following results:

	No. of Boats.	Tonnage.	Average Tonnage.	Average Speed.
British	36	299,629	8,325	16.65
American	35	376,231	10,750	16.91
German	23	252,391	10,970	17.01

The next table shown is that of twin-screw steamers above 7,000 tons with a speed of over 11 knots:

	Before the Deal.	After the Deal.
British	78	38
American	9	54
German	44	44
French	4	4
Russian	2	2
Danish	1	1
Dutch	5	None.

Of single-screw steamers of over 7,000 tons, the majority of them having a speed of over 11 knots, the table shows a change much less in proportion. The figures are as follows:

	Before the Deal.	After the Deal.
British	49	42
American	2	9
German	4	4
French	3	3
Austrian	1	1

Combining all steamers of over 10,000 tons, the following showing is made:

	Before the Deal.	After the Deal.
British	36	10
American	8	38
German	25	25
French	2	2
Dutch	4	None.

The percentages of the passenger trade work out as follows, taking only the three most important nationalities:

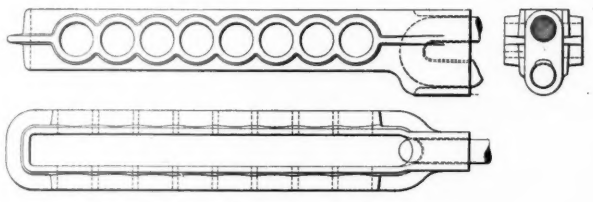
The German lines carried.....39.5 per cent. of the total
The American lines carried.....26.1 per cent. of the total
The British lines carried.....14.9 per cent. of the total

The figures given are for the year 1901, and the proportion credited to the American lines includes all the ships which have since that time been taken over into American control.

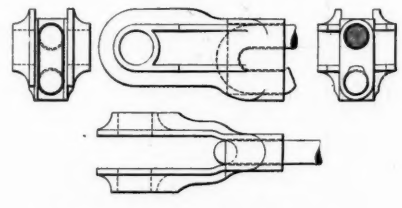
The London *Statist*, from which these figures are quoted, has little confidence in the endurance of the existing laws of the United States which forbid the flying of the Stars and Stripes by any foreign built ship and asks rhetorically if anybody believes that if the American Congress was confronted with an application for a change in the law which would alter the whole aspect of the mercantile fleets of the world, such application would not be granted.

The National Brake Rod Jaw and Dead Lever Guide.

The National malleable iron brake jaw and dead lever guide shown in the accompanying illustrations are designed to form a connection between the brake jaw, or guide, and the brake rod, without welding. The danger of accident from imperfect welding is avoided, and no up-setting of the rod is required to form a head. It is also unnecessary to drill for the connecting pin holes; thus, not only is a saving in time and labor effected, but greater safety is attained. The application of the rod to the jaw is very simple. The casting is slipped on to the rod through one of the two parallel holes in the end and the rod is then bent into the form of a pot hook over a mandrel and slipped through the other parallel hole. The end is bent over slightly to prevent the jaw slipping back. A recent test of one of these brake jaws shows that the strength of the casting is greater than the strength of a rod of any material which may be attached to it. A jaw was fitted with a ¾ in. wrought iron rod and tested to destruction. The iron rod broke at 22,500 lbs. A bar of crucible steel was then supplied instead of the ¾ in. wrought iron rod and it, in turn, was broken at 35,100 lbs. Those in charge of the test were unable to find anything sufficiently strong to hold the jaw to the breaking point of the casting. At the conclusion of the test the jaw was apparently in good condition with the exception that the holes for the pin were slightly elongated, but not sufficiently so to cause any difficulty in removing the pin.



National Dead Lever Guide.

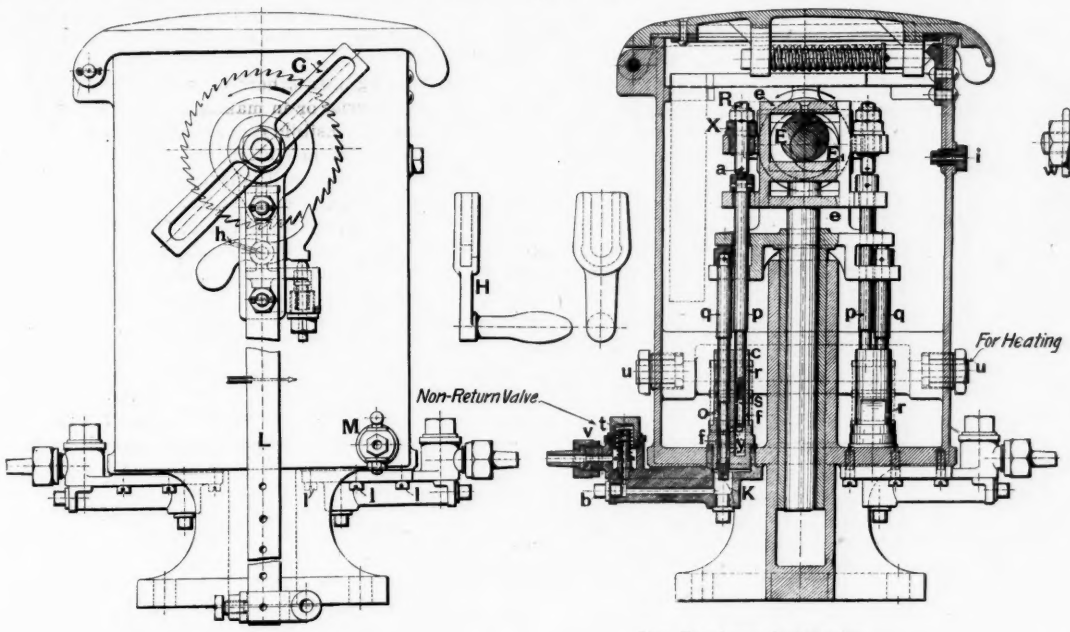


National Brake Rod Jaw.

These jaws and dead lever guides have been in service for five years, and a broken one has never been reported, although there are at the present time over one hundred thousand in use. The jaws and guides can be furnished for ¾ in., ⅞ in. and 1 in. rods, and the jaws with one or two connecting pin holes. These devices are made by the National Malleable Castings Co., Cleveland, Ohio.

The Friedman Lubricator for Locomotives.

The new Atlantic compounds of the Baden railroads mentioned in our issue of March 20, page 217, have been equipped with the Friedman patent lubricators, and an illustration of this new device is given herewith. Any one who has ridden on a locomotive, and has experienced the discomfort caused by the breaking of a lubricator glass, will appreciate the advantages to be derived from any contrivance which removes the high pressure steam from the surface of the oil.



The Friedman Lubricator.

The apparatus in question contains four lubricating pistons which are operated by the double eccentric E E', which is rotated by means of a ratchet level L. This causes the packing pistons p and q to move up and down. The piston p draws the oil from the outer vessel through the hole o and the upper hole y, and forces it through the lower hole y into the pressure space k. From here it passes out through the non-return valve to the several parts to be oiled. The movements of the two pistons, p and q, relative to each other, is such that the pressure space is never in direct communication with the oil vessel. By this means it is possible to fill the lubricator without stopping its action. The quantity of oil discharged at each stroke depends on the movement of the piston p. The stroke can be regulated by means of the screw R. When the screw is completely down the pump is working at maximum capacity and discharges about ¼ gram each stroke. The discharge is minimum when the screw R is out as far as is permitted by the pin a.

The apparatus is provided with a strainer under the cover and there are also separate cylindrical strainers around each of the pistons, thus insuring that no foreign substance shall get into the distributing pipes. The graduated wire z indicates the level of the oil, and the apparatus is so designed that the level should never be permitted to get below the point marked o on this wire. The small aperture i is for the purpose of preventing excessive filling of the vessel and also to insure that the interior of the vessel is always at atmospheric pressure. The discharge M serves for emptying the oil vessel but is used mainly to determine whether any water is in the bottom of the oil chamber. The non-return valve V prevents steam or water of condensation from flowing back, if the filling of the vessel has been neglected. The passage U, which is in connection with boiler steam, is provided for the purpose of heating the oil in very cold weather or after a long stop.

Inasmuch as all the moving parts are within the oil vessel, with the exception of the ratchet lever L, the pawl h and the brake at m and n, the oiling of the mechanism requires but little attention.

When it is desired to remove the pistons for the purpose of repairing or cleaning, all that is necessary is to remove the small screws, l, when the piston casing can be drawn out straight. The piston q is next moved to one side and lifted out and then the piston p is drawn out, after removing the screw union X.

The ratchet wheel has 13 teeth and is 120 millimeters in diameter. It is stated that in new locomotives the apparatus has to be set for a feed of two or three teeth, according to the size of the locomotive.

This lubricator was designed by Alex. Friedman, 44 Rue Bouret, Paris, France.

Paris Tramways.

The conflict between the tramway companies and the Municipal Council of Paris concerning the relations between the tramways and the city, which was brought before the Chamber of Deputies in November, last, is now practically settled on terms agreeable to both parties. The *Engineer* (London) says that the primary cause of the trouble in which the tramways find themselves is to be traced to the vast speculation some years ago, when a large number of companies sprang into existence solely for the purpose of acquiring concessions, to get which they were willing to subscribe to the most onerous conditions. By the aid of electricity, the tramways were to transport hundreds of thousands in and out of Paris daily, at uniform fares of 3 or 4 cents. Unfortunately they did not take sufficient account of the difficulties. The alterations and repairs proved enormously expensive and in less than two years the inevitable crash occurred. By the aid of English capital the Compagnie Generale de Traction, which controls most of the lines, was tided over the difficulty, and the important part played by English capital was partly responsible for the hostility displayed by the Chamber of Deputies toward these companies. Since then, matters have been going from bad to worse. One company stopped working its lines at the end of 1901, and another is losing heavily; and the Est Parisien has been glad of an opportunity to al andon the Diatto contact surface system, which has proved very costly and was the cause of fatal accidents to a large number of horses.

The companies now ask for an extension of the period of concession, and a revision of the contract clauses, enabling them to increase their fares. The Minister of Public Works was opposed to this, but as the majority of the companies were on their last legs, he found himself obliged to do something for their relief; and he has granted relief to one of the companies—the Compagnie Electrique des Tramways de la Rive Gauche de Paris. This concern holds three concessions, comprising a line from Boulogne to Vincennes; from Arcueil to the Luxemburg in Paris, and from Montreuil-sous-Bois to Boulogne. The first line has been suspended and the second has been abandoned. As regards the Montreuil-Boulogne line, the only one worked by the company, the Government has consented to the creation of three sections inside Paris, with 4 cent and 3 cent fares, according to class, for each section, and an additional 1 cent for each other section, so that the entire first-class fare inside Paris will be 6 cents. This arrangement is to remain in force for six months.

Interior of Twentieth Century Limited Dining Car.

New Diners for the "Twentieth Century Limited."

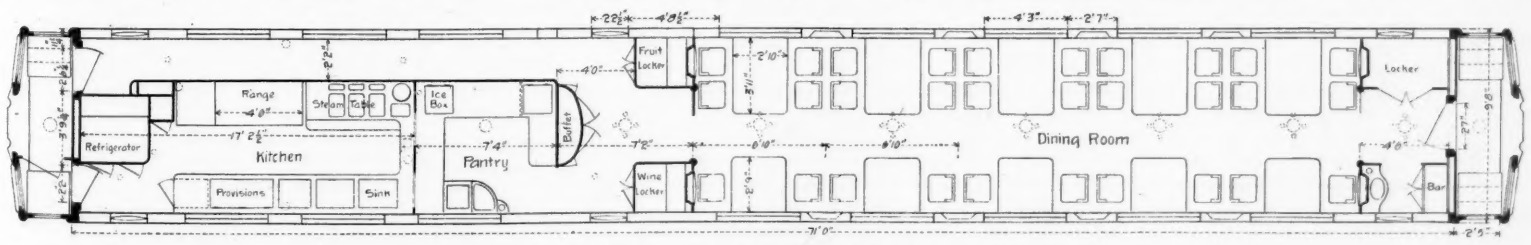
For the 20-hour trains between New York and Chicago the Lake Shore has recently received from the Barney & Smith Car Co. two new dining cars, a floor plan and interior view of one of which is shown. They are 71 ft. long over end sills, 9 ft. 8 in. wide over side sills, and have been framed with extra care to insure rigidity of structure; also the ends are equipped with the builders' anti-telescoping device. They are carried upon six-wheel trucks and are equipped with Westinghouse high-speed brakes.

In general interior arrangement the cars are similar to those already in use on the Lake Shore, and seat 30 people. The finish is St. Jago mahogany, inlaid with marquetry designs, instead of carving. Over each window in the dining room is a semi-elliptical metal frame set with opalescent art glass of a checkered pattern. The deck lights and the bulkhead arches are fitted with art glass of the same pattern. The cars are equipped with Consolidated axle light and Pintsch gas systems, the deck fixtures being of the combination pattern. Over each window, which also brings them over each table, are bracket electric fixtures having two lights.

Foreign Railroad Notes.

The Danish State Railways management is arranging to put "small libraries of good and useful" books in third-class cars for the free use of travelers. This is said to have been done to a considerable extent on third-class trains in Sweden.

The Bengal Nagpur of India has received 12 new engines with a leading bogie and six coupled wheels, similar to those built for the Great Central (England). These engines have 1,831 sq. ft. of heating surface, a Belpaire fire-box with 32 sq. ft. grate area. The driving wheels are 73½ in. in diameter, and the steam pressure is 180 lbs. per sq. in. The cylinders are 21 in. x 26 in. The tender holds seven tons of coal and 3,500 gallons of water.



Floor Plan of Dining Car, Twentieth Century Limited. L. S. & M. S.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY
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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The maximum power which the locomotive is capable of delivering is dependent upon the efficiency with which the cylinders use the steam, and the amount of steam which can be furnished by the boiler. Any design, therefore, which results in an increased number of pounds of steam evaporated per square foot of heating surface is a direct gain in the maximum power which the locomotive can develop. Likewise, any device or design which has for its purpose the reduction of some of the heat losses in the cylinders will result in an increased maximum power. Considerable time and energy has been spent in attempting to increase the power of a locomotive by modifying the steam distribution in the cylinders. Experiments show, however, that the present Stephenson link motion, which gives a card far from the theoretical at high speeds, is, nevertheless, quite efficient. In fact, the cylinder economy of the simple locomotive is better than that which can be obtained from most single expansion high speed stationary engines. A simple cylinder locomotive will oftentimes operate with a steam consumption of but 26 lbs. per h.p. per hour and even by the use of compound cylinders this quantity cannot be reduced by more than 15 or 20 per cent. It would appear, therefore, that there is but a narrow margin for an improved valve design having for its purpose the reduction of the steam consumption of a simple cylinder locomotive. The suggestion which Mr. Cheney makes in another column concerning the adaptability of the modified Corliss valve to locomotives working at high speed contains nevertheless some features which are worthy of consideration. The use of independent admission and exhaust valves may, by reason of the reduction of initial condensation and clearance, result in some economy. The use of such a device would seem to depend upon whether the increased cost of the independent valves, including cost of maintenance will be more than offset by the increase in efficiency.

A Chicago reporter with a gift for generalizing says that the railroads in that region are going to enforce more rigidly than ever before the rule that an engineman must stop when he encounters a stop signal; and that enginemen are no longer to be permitted to run an engine when they are worn out by overwork or lack of rest. To the newspaper reader this must be rather blind. It is true that an official report has been published showing that in one year in the State of Illinois 138 engines ran off derailing switches, apparently because their runners ignored the stop signal set to warn them against such a mishap; but not many newspaper readers have seen that report, and to the "lay" mind the requirement to stop at a stop signal would seem to be axiomatic; the proposition to begin now to enforce it must be a joke. On inquiry we find that there is a basis of truth for the report. It is "news," in that it has not before been made generally known; but it is a year or two old. The reporter refers to the Chicago & North Western, and he used the word "railroads" because presumably the high ethics of his journalism forbid him to single out a road by name. The North Western, as the readers of the *Railroad Gazette* have been told, has for a good while done a thing which few other roads do; it tests the behavior of enginemen at automatic signals (and at other points where there are no regular watchmen) by displaying actual stop signals at unexpected times, thus detecting men who are heedless, or who use their judgment where the exercise of judgment is forbidden. Collisions in consequence of disregard of automatic block signals are not numerous, but they have come to be sufficiently frequent to warrant giving prominence to this excellent North Western practice. Such inspection is needed everywhere; for errors like that which caused the terrible Westfield disaster in January could be reported at many other places if all superintendents were to unbosom themselves.

The rule to run no risk of having those collisions which result from enginemen falling asleep in their cabs was also found on the North Western. The trouble with this rule is that no superintendent can enforce it, except with the aid of the engineman's conscience—and intelligent courage. The most practical thing in the shape of a rule is a requirement that registers be kept at all terminals, by which an inspector can see at a glance whether or not every engineman (and every fireman) takes enough hours off between trips to allow himself adequate rest. Such registers have been kept on the North Western for a year past, and they give the superintendent definite knowledge where, otherwise, he must depend on partial and unsatisfactory information gathered from a number of different sources. Of course, to accomplish the purpose of the register he has two important duties; first to "jack up" those clerks or foremen—there will always be some of these—who are lax in keeping the record; and second to see that the rest-periods are not unduly shortened by those runners who are over-anxious to make money. Such runners, unfortunately, have all too much aid and comfort from despatchers who need more enginemen than they can find. Mr. W. K. Muir many years ago laid down a number of homely rules for superintendents, one of which said that an important duty of the division superintendent was to see that his trainmen went on duty "fresh and rested." These words do not appear in the modern and ultra-dignified laws of the American Railway Association, but none which do appear there represent a more essential idea. The reason for mentioning a third necessary element in the means of carrying out this idea is that the first element (the superintendent's care) and the second (the engineman's conscience) do not provide against those cases where a runner thinks it his duty to overwork himself to promote the prosperity of the company, or believes that he must perform his duty on the engine for the benefit of his family, in spite of a sickness or anxiety which may really incapacitate him. No officer or inspector can know whether a man who has been off 8, 12 or 16 hours has been sleeping or working, quiet or anxious; yet without this knowledge the book record is of quite limited value. We need the book record plus the knowledge that it records the doings of high-class men. But in any event the record is of decided value as an element in the foundation needed for perfect discipline, and every superintendent should desire it for his own peace of mind. The Government inquiries about accidents now ask whether men responsible for collisions have gone on duty after less than 7 hours' rest. It is a good thing to be able to feel, the moment an accident is reported, that your record in this respect will bear inspection.

Recognizing the Brotherhoods.

"Inasmuch as the labor organizations are here to stay, it occurs to me that it is better to reckon with them; and until they show that they are altogether undeserving, treat them in a respectful and considerate manner." This is quoted from the letter of a general manager of a large road. Its modesty in form and its straightforwardness are strikingly suggestive of the way of thinking and writing of another great man—General Grant. In decided contrast with this is the following sentence quoted from the general superintendent of a considerable road: "The principle by which I am governed is not to recognize any union; to deal with employees who have grievances, directly, and not because of their belonging to any union, or through any union officers." How reasonable and defensible both of these diametrically opposing attitudes appear—to one who knows nothing of the subject! One of them is based on a condition which undoubtedly confronts us, while the other is based on the sound theory that a trustee cannot rightfully or lawfully delegate his trust to outsiders. There is also involved a feeling of personal dignity—that it is odious to be dictated to—but this must not count.

In dealing with others to whom money is paid, in buying material or in making contracts, it is usual to consider responsibility, quality, price and time of delivery. There are often other considerations, but these are prime. If it is true that labor organizations "are here to stay," as the history of more than a hundred years seems to indicate, the considerations in dealing with them are generally but not precisely like those which govern in making other contracts. Every decent man knows that it is foolish to make a bargain with a person who does not keep his word, or who resorts to violence and unlawful methods to force a bargain or to break one. It is dangerous to negotiate or make agreements with a liar, or to buy goods from an outlaw. A union which breaks its agreements deserves to be ignored; and one which encourages violence and lawlessness should be broken up. A corporation officer knows the folly of making a contract with an irresponsible concern which fulfils the contract if it is profitable and agreeable but "lies down" in the event of loss or damage.

The brotherhoods and the trade unions are not incorporated and have no capital. By ordinary business rules they have no basis for negotiating a contract requiring the payment of money for work done or for penalties for failure to perform. But the present tendency of court decisions is to hold the individual members responsible to the full amount of their property for damage done by their union. In Rutland, Vermont, a manufacturer obtained last week judgment for $12,000 damages against the officers and members of a union that boycotted him, after the usual incidents of a strike followed by persuasion and besetting of the non-union men who took their places. The union officers destroyed their records and fled from jurisdiction. The individual properties of the local members were attached, and a good many of the frugal poor will lose their all, while the organizers and grand chiefs in exile are probably mortified but not resigned—from their salaried offices. This is the same judicial view lately held in England, and by the brotherhoods it is to be "reckoned with."

It is evident, in the letters from thoughtful railroad officers printed on the first page of this issue, that other considerations than those of financial responsibility will govern in recognizing unions. The big requirement of strict discipline in order to give safe and efficient public service overwhelms the minor matter. It is unfair to some of the brotherhoods, but it is fair to say of most of the unions that their officers are not in business for their health, or for the uplifting of their members, or for the public good. While the great majority of the railroad employees are disposed to be faithful and loyal to duty, nevertheless (to quote from one of the letters): "There seems to be a feeling against the man who takes the side of his employers. I do not know why this is so; I simply know that it is, and because of that the good men usually keep still and the bad men do the talking and manufacture the sentiment."

Some events in industrial history show that organizations of employees in each class of railroad service can be made good things both for the men and the company and for the public. This is indicated in many of the letters received. Individual employees, or unorganized groups, cannot adequately present their side. Neither the corporation nor officers endowed with Heavenly qualities, and having wisdom, can deal satisfactorily with large bodies of employees without knowing their sentiments as well as their conditions. The men need and have, and will surely continue to have, spokesmen. Left to themselves they will be bad; but, enlightened by employers, voluntarily treated with justice and with stern discipline, they may be better. St. Paul, after berating the Romans, exhorted them: "Let us walk honestly, as in the day; not in rioting and drunkenness, not in chambering and wantonness, not in strife and envying." History does not tell the immediate results of the Apostle's work against concealment and lawlessness, but, through all the ages since it has been a power for good.

There is no intention, here, of giving advice; the purpose is simply to develop the facts, and the plain business principles. If a brotherhood is to be recognized, ground is lost by doing it grudgingly. The humiliation of a refusal is severe; the relenting, under

threat of striking, causes unholy glee. A wounded animal is apt to be a dangerous one. A quick acceptance of the inevitable, a willingness to correct injustice and a flat refusal to violate principle form as good a basis for business with a labor organization as with another company. Where such treatment fails, there is the law; and meantime the work of enlightenment can go on.

Umbrella Sheds.

Three or four years ago we asked the questions: Is it worth while to build great costly train sheds? Is it not a serious mistake? Have we not been led astray by the notion that these train sheds have an important advertising value? To these questions we never received any answer except in conversation with railroad officers. Naturally there are differences of opinion, but we discover that many officers of large experience and of sound judgment agree fully with the opinions expressed in the editorial article which ended with those questions. We shall now re-state some of those opinions in a different form and perhaps with some additions as the result of further thought and observations.

The question is as to the policy of building great train sheds at large terminals or of protecting train platforms by umbrella sheds. There is such a difference in first cost and in cost of maintenance that the argument for the train shed must be very strong to justify it. We need not dwell upon the differences in cost. Everyone who has built train sheds and maintained them knows how expensive they are, and that maintenance is a more serious matter than the interest on first cost.

The first object of any form of protection is the comfort of the passenger. In comparison with this all other considerations are unimportant. A careful study of the matter will show that almost everywhere in the United States, perhaps everywhere, the protection of train platforms by umbrella sheds will give the passenger more hours of comfort in the year than protection by train sheds. This is largely a matter of climate. In St. Paul, where the winters are long and cold and the snowfall heavy, the advantage might perhaps be on the side of the train shed. In Washington the advantage would unquestionably be on the side of the umbrella shed. Apart from actual protection from the elements is the matter of the relative cheerfulness of the surroundings. The umbrella shed arrangement is lighter, cooler and entirely free from gas and smoke. Here again local conditions complicate the question as, for instance, at Pittsburg, Chicago and St. Louis, where the prevailing gloom is intensified by the use of enclosed train sheds and where ventilation is made more difficult because of the amount of black coal smoke in the air. But we may state the matter in a general way.

In our fortunate country the weather is fair and the temperature is moderate for most of the hours of the year. Then the passenger needs no protection as he goes to his train. The umbrella shed gives him shade, keeps off the showers and leaves him light and air. What more does he want? In the summer there are many hours of considerable heat. Then the train shed becomes uncomfortable—to put it mildly. Every one can remember minutes of extreme discomfort passed sitting in a train in a train shed on a summer day. If one travels every working day, as do most of the passengers who use the great terminal stations, those uncomfortable minutes are multiplied into hours in the course of a summer. Finally, in the winter there are a few days of extreme cold and a few snowy days when the passenger will find it comfortable to have the protection of an enclosed train shed. But probably he has walked to the station and will walk to his home at the end of the journey, and the protection which he has enjoyed while walking 50 yards along the station platform has been for only a trifling percentage of his journey. He has dressed for a walk through the storm and the three-quarters of a minute on the station platform would have added nothing to the sum of his discomforts if there had been not even an umbrella shed over it. We must remember, in reasoning on these matters, that relatively very few passengers go to and from stations in carriages. These few individuals fill a certain place in the imagination of the G. P. A. but they add little to revenue.

The writer of these lines reasons from a pretty large store of observed facts. For five years nearly every working day he went in and out of a station handling a very large suburban business on platforms protected only by umbrella sheds. He began with the usual prejudice against umbrella sheds, and is now satisfied that, so far as comfort goes, the weight of argument is in their favor by (let us say at a guess) ten to one.

All of this is quite apart from the question of the advertising value of the stately and spacious train shed. That question we do not care to discuss now; but the interest on the first cost and the cost of maintenance of that train shed would pay for a big mass of good advertising literature that could be distributed all over the continent.

The heritage of debt contracted by municipalities to aid in building railroads during the frenzy of new railroad building, which caused the financial panic of 1873 and closed with it, has outcropped in queer forms, but in no case more striking than in a bill which is receiving considerable support in the Legislature of Connecticut. During the railroad fever referred to not a few towns and a number of the cities all over the country plunged recklessly into the "town aid" business. Packed town meetings approved issues of bonds to raise money for stock investments in projected railroads, and, in most cases, the "town stock" was snuffed out by later foreclosure and reorganization; and to such a pass did the evil come that by a constitutional amendment in 1877 in Connecticut (and at about the same time in many other States) "town aid" of railroad building was absolutely barred. But the town railroad debts have survived and, in the processes of refunding, the burdened municipalities now come before the Legislature with an appeal to "swap" town credit—on about a 4 per cent. basis—with State credit on a 3 per cent. basis. The towns ask the State to take up the maturing town debts, accept the town bonds to an equal amount as security and pay back to the town the difference in interest amounting to about 1 per cent. In favor of the novel proposition the single argument is advanced that the State and not the town taxes Connecticut railroad stock and bonds and should therefore lend a hand to the towns in carrying the load. That such a plea will prevail against the *caveat emptor* principle of the original investment, the unwisdom of the State's entering a local banking business and the obvious menace of a precedent that may be stretched to other town debts, is not likely. But that a plan of the kind should appear and be pressed in the Legislature of a New England Commonwealth—albeit with a fat treasury—is a suggestive commentary on certain socialistic trends of our time.

Illumination of the side numbers in engine headlights is oftener bad than good. Various schemes have been tried for having enough light reach these figures without reducing the effective reflector area. Tests have shown that a portion of the reflector at the vertex of the parabola has no appreciable effect upon the illumination; and that this part may be cut away without reducing its intensity. This fact was taken advantage of in a scheme that originated on the Burlington a number of years ago. A hole was cut in the apex of the reflector and back of this a small reflector was so placed that it would direct the rays upon the numbers at each side. Another plan was to make the opening for the lamp chimney large enough to let sufficient light through to illuminate the numbers. In still another, small reflectors were placed at the front just inside the goggle. The general practice now is to have apertures in the reflector on each side of the light, it having been found that the slight shadow due to the cutting out of a part is not noticeable from the cab. But the size of this aperture does not seem always to have received proper consideration. Naturally the more figures there are in the number the larger must the opening be horizontally. Not only this, but experiment has shown that the opening should be triangular, the short base being toward the front of the reflector. This arrangement has been standard on the Pennsylvania for some time. The Burlington is now enlarging the small, elliptical openings in the reflectors of all headlights which have numbers of four figures, and will make them the shape of the openings in the Pennsylvania standard lights.

The Bessemer & Lake Erie Railroad report (for 1902) again shows the extraordinary capacity of a railroad whose traffic is nearly all of a simple nature and chiefly through coal and coke in one direction and ore in the other. The company has 203 miles of railroad and the average freight haul last year was 127 miles; and for every passenger-mile there were 70 ton-miles. The heavy freight traffic of the road, equivalent to 5,754 tons each way daily over the whole mileage, was carried by an average of only 6.3 freight trains each way daily, so that we may assume the road to be capable of carrying very much more traffic if it can be handled at the termini. The average trainload of 913 tons is not equalled or approached on any other railroad, so far as reports show; but doubtless sections of great systems which report only the averages of the entire system have actually immensely greater trainloads than such average. Yet the Bessemer & Lake Erie trainload was larger in 1901 than last year owing to the fact that coal shipments to Lake Erie did not keep pace with ore shipments from the lake. With an average rate of 0.419 cent per ton per mile, the gross earnings per freight-train mile were no less than $3.82, at a cost of $2.03, which may be contrasted with the 66.6 cents gross earned per passenger-train mile.

The discontent among railroad and dock employees in Holland culminated on Monday, April 6, in a general strike which stopped traffic for a day or more, although all through passenger trains were not abandoned, though badly delayed. The men are striking, not for better pay or shorter hours, but to show their opposition to a proposed law for the prevention of strikes. The Government proposes an Act making it a criminal offense to stop work without notice, and there is a scheme for organizing the higher classes of railroad employees into a Government corps, with military regulations. The railroads of Holland, though largely owned by the State, are not worked by it directly, but by two operating companies. The strike last January was apparently a "sympathetic" strike, in behalf of the employees of certain shipping companies, and the surrender to the strikers was regarded in Europe as a very serious matter, likely to be a dangerous precedent. The bill which has been introduced by the Prime Minister to prevent a total suspension of transportation by any future strike has not been described in detail, but it provided for an organization of a certain body of employees on military principles, by the aid of which the most indispensable train service might be kept up under all circumstances, and for the protection of such men as might be willing to serve when the great body of the employees were striking. Latest mail advices say that a member of the Parliament, editor of a journal regarded as an organ of the employees, had used conciliatory language in the Parliament, and affirmed that under existing circumstances no strike was contemplated; but that if the bill was pushed, a strike would certainly result. It seemed to be the general opinion that if the bill were not withdrawn, it would pass by a large majority. The political aspect of the present situation is complicated by the nearness of Germany and its restless socialists.

On April 1, Judge Elmer B. Adams in the United States Court at St. Louis, dissolved the injunction issued by him on March 3 at the instance of the Wabash Railroad to restrain the Brotherhoods of Trainmen (brakemen) and Firemen from ordering a strike on that road, and from "ordering or persuading" the employees to quit the service of the company. The primary ground alleged by the Wabash, in seeking the injunction, was that there was a conspiracy to interfere with interstate traffic and with the carrying of the United States mails. It was alleged, also, that the defendants were guilty of conspiracy to secure recognition of their powers as officers of the unions, by forcing a strike which was not desired by the employees involved. The defendants particularly denied any purpose to interfere with interstate commerce or with the carrying of the mails. They denied also that the strike was "undesired," and that coercion had been used. Judge Adams points out that the injunction was intended to give time for investigation of the complaints made before precipitate action, in the form of a strike, should be taken. It does not appear, however, that any new information has been brought out which will be of service in settling the difficulty. On the other hand, the confusion in the definition of the term "strike" as distinguished from "conspiracy," has been increased. The logical conclusion to be drawn from the removal of the injunction seems to be that a strike is a conspiracy if the unions are not prepared to swear to the contrary; otherwise it is no conspiracy.

NEW PUBLICATIONS.

Continuous Current Dynamos and Motors and Their Control. By W. R. Kelsey. London: The Technical Publishing Co., 1903. Price 5 shillings.

The first four chapters of this book covering the fundamental principles of magnetism and induced currents as applied to the design of dynamo electric machinery are from the pen of another writer and originally appeared as a series of articles in *The Practical Engineer*. They serve as an excellent introduction to the author's further treatment of continuous or direct current machines in detail which begins with the study of the design and construction of armatures. This subject is treated at length both from the theoretical and practical standpoint, and numerous winding diagrams and tables are given for each of the many forms of ring, drum and disc wound armatures. The chapter on the theory of commutation, following those on field magnets and exciting coils, shafts, bearings and brushes, is especially good. Motors and systems of speed control with special reference to street railroad work forms the basis for an interesting chapter which deals in a practical way with the apparatus now in use. The description and comment is confined to those systems in use on the Continent and in England, but little mention being made to the many radically different systems in use in this country. The closing chapters are devoted to the study of the characteristic curves of different types of machines on whose value the author lays much stress as indicating with much greater clearness than figures or worded statements, what the machine is capable of doing.

The book is replete with illustrations and diagrams of windings and connections which add materially to its value as a book for reference or instruction. Many laboratory experiments are described in detail with the necessary deduction of formulæ for the application of the acquired data to the design of dynamo electric machinery. The volume is bound in cloth, contains 435 pages and has a good index.

How to Become a Competent Motorman. By Virgin B. Livermore and James Williams, New York: D. Van Nostrand Co., 1903. Price $1.

The object of this book as stated by the authors in their introduction, is to instruct motormen in the proper handling of the different forms of electric equipments now

in use on electric railroads. Following a brief description of the various common forms of controllers, motors and auxiliary apparatus is a catechism of questions and answers on the operation of a car, intended to cover the points set forth in the preceding pages. The illustrations are crude and the whole book cheaply got up. It is made in pocket form and contains 230 pages without an index. The price seems to be out of proportion to its value or usefulness.

Elements of Steam Engineering. By H. W. Spangler, Professor of Dynamical Engineering in the University of Pennsylvania; Arthur M. Greene, Professor of Mechanical Engineering, in the University of Missouri, and S. M. Marshall, B. S. in E. E. New York: John Wiley & Sons, 275 pages, 6 in. x 9 in., 273 illustrations. Index. 1903. Price $3.

This book is written primarily for first year students in engineering schools. The forms of steam apparatus used in modern steam plants are simply and briefly described. The headings of the nine chapters are: boilers, boiler details and accessories, boiler room auxiliaries, the slide valve, steam engine, engine details, valve motions and diagrams, indicating and governing, governors and valves, and condensers and multiple expansion engines. Theory is purposely avoided, although in the last chapters there is much that will not be thoroughly comprehended by first year students. The chapter on indicating and governing is particularly interesting and the effect on the indicator card of defects in valve setting is made clear. In explaining the significance of "open and crossed" locomotive eccentric rods it is stated that, "when the crank is on the opposite side of the shaft from the link the rods are said to be open, if, in this position they do not cross." This definition is correct provided the valve motion is indirect-acting, and the valves have external admission. The authors' definition would not hold for a direct-acting valve motion with valves having external admission.

The book is well written and the illustrations are well selected.

Safety Appliances and Accident Reports. The Interstate Commerce Commission has issued in pamphlet form that part of its last annual report which relates to these two subjects, and copies may be had from Edward A. Moseley, Secretary, Washington. There are five pages summarizing the reports of the Commission's inspectors of the condition of freight cars throughout the country, and the same number of pages about the accident records, showing causes of collisions, etc. The full annual report has not yet been issued. A synopsis of it was given in our issue of Dec. 26, 1902. The facts concerning accidents have been given in the *Railroad Gazette* from time to time, as the quarterly accident bulletins appeared. The annual report supplements the bulletins by a chapter on the need of using the block system. The Commission recommends that *all* accidents be reported by the railroads monthly and that accident statistics be omitted from the annual reports of the railroads and of the statistician of the Commission. The appendix to the pamphlet contains the report of the chief inspector, with a large table showing by months the defects in cars reported by the inspectors; the tables of accidents for the year ending June 30, 1902, and two articles from the *Railroad Gazette* commenting on the collision records.

Steam Power Plants. Their Design and Construction. By Henry C. Meyer, Jr., M. E., New York: McGraw Publishing Company, 114 Liberty street, 159 pages, 6 in. x 9 in., 65 illustrations. Index, 1903. Price $2.

"No better service can be done the non-expert about to construct a steam plant, than to advise him to engage at the outset of the project some capable engineer to design the plant and superintend its construction." This is quoted from the first paragraph of the book and is good advice. Nevertheless a considerable number of power plants will be built each year without expert advice, and the book is designed to aid those of semi-technical training. It discusses the important features in the design of steam power plants, and if read and understood, no serious blunders on the part of the "non-expert" should occur. The work is concise and to the point and is free from useless details and difficult theory. The expert will also find much of interest, especially in the 16 full plate engravings of some modern power plants which show the general design and arrangement of machinery. The specifications for boilers and engines are also of value.

A Visit to America.—By Lieut.-Colonel H. A. Yorke, R.E., Chief Inspecting Officer of Railways for the (British) Board of Trade. London: Eyre & Spottiswoode, East Harding street. Price 5d.

This is the title of the blue book, No. Cd. 1,466, which has been issued to give the public the benefit of the observations made by Colonel Yorke on the railroads and street railroads of America last October. A brief abstract of the report was given in the *Railroad Gazette* of March 20, p. 216, but the full report, since received, contains a variety of interesting details which were not shown in the abstract. Colonel Yorke's statements of fact are in a few cases slightly inaccurate, as was almost inevitable, because he hurried, but his observations are in the main precise and intelligent; and they everywhere bear the mark of impartiality. Twenty-five pages of the book are taken up with a diary. This is by no means the least interesting portion, as it contains many notes of interest to railroad men, that do not appear in the main body of the report.

TRADE CATALOGUES.

Portable Tools for Railroad Repair Shops.—H. B. Underwood & Co., (L. B. Flanders Machine Works), Philadelphia, Pa., have just issued a catalogue of portable tools made by the company. It measures 6 in. x 9 in., and contains illustrations and descriptions of a varied line of machines, including portable locomotive cylinder boring bar and fixtures, boring bar for lathe work, portable facing arm, valve seat rotary planing machine, locomotive cylinder or dome facing machine, milling machine, crank pin turning machine, radius planer attachment, eccentric mandrel turning machine, and extra large crank pin turning machine. Two pages are devoted to information for railroad men and machinists.

C. W. Hunt Company, New York.—Bulletin No. 0223 describes a number of storage battery electric locomotives for both standard and industrial or narrow gage tracks in and around buildings and yards of large factories. These locomotives as built by this company are made in sizes from four to six tons for narrow gage and from 12 to 20 tons for standard gage. Two independent motors are used to drive and they are mounted above the platform out of harm's way and where they may be readily inspected. The batteries are generously proportioned and are also placed above the platform. This form of traction for factories and mill yards has many advantages, all of which are set forth in the bulletin just issued.

Westinghouse Fan Motors.—The Westinghouse Electric & Manufacturing Co., Pittsburg, Pa., has issued two attractive catalogues of fan motors, one of which is much smaller than the other, although containing in condensed form practically the same interesting information. The application of electric fans to shops, trains, offices, hotels and many other places is illustrated by numerous handsome engravings, and the constructive features of both the direct and alternating current fan motors made by this company are also shown and described.

The Niles-Bement-Pond Company has issued a 9 in. x 12 in. catalogue of 47 pages entitled "Horizontal Boring, Drilling and Milling Machines." In the first section are illustrated a number of recent designs, and in other pages are a few illustrations of the machines at work. In this type of machine the work is bolted to a floor plate and a number of operations such as boring, milling and facing may go on at the same time and with one setting. The illustrations and press work are excellent.

Railroad Shops.*

BY WALTER G. BERG, *Chief Engineer, Lehigh Valley.*

IV.

Number of Erecting Pits.—The proper size of the locomotive shop depends on the number of erecting pits, and the latter on the total number of engines that the shop in question has to keep in repair.

Reliable data on this subject is hard to obtain, especially as to the number of engines requiring heavy repairs and boiler work and those calling only for comparatively light repairs. On most railroads a large amount of repair work, even of a heavy character, is done at various small division or emergency shops.

The information at hand is as follows:

1. Buffalo, Rochester & Pittsburgh Shops, Du Bois, Pa., 1901. Total engines, 183. Number to be repaired at Du Bois in 1901 stated to be 147, and an allowance of 15 engines increase per year for five years was made. The total number of engines to be provided was, therefore, 200, or, if each engine is to be put through the shop once a year for heavy repairs, 17 engines per month. The designers assumed 20 days for each engine in the shop, and that each pit would, therefore, turn out 1½ engines per month, and 12 pits would provide for 18 engines per month. Assuming one-third as many boilers and tanks in the shop as engines, the above equipment of 200 engines would require a shop capacity for 12 engines, six boilers and six tanks at one time. Shops were built for 14 engines on working tracks. Hence the ratio of engine pits to equipment, at the time of construction was 9.5 per cent., and allowing for five years' increase, 7 per cent.

2. Pittsburgh & Lake Erie, McKees Rocks, Pa., 1902. New plant designed with 24 erecting pits and 18 boiler tracks. Present equipment, 142 locomotives, or engine pit ratio is 17 per cent. Technical journals state that the total equipment will be 180 engines in 1903, making the pit ratio 11.3 per cent. This shop cannot be extended, and hence the capacity was evidently made looking forward to the future increase of equipment.

3. Great Northern, St. Paul Shops. Total equipment for over 5,000 miles of road is 566 engines. New locomotive shop, 1902, at St. Paul, 25 erecting pits, or 4.5 per cent. of total equipment. The road has other shops.

4. Lake Shore & Michigan Southern, Collinwood, O., 1902, 24 erecting pits. Total equipment, 582 engines. Published statement, taking care of 350 engines in 1902, or engine pit ratio, 7 per cent. It is claimed that the facilities will eventually allow 450 engines per year to be taken care of, or pit ratio, 5.3 per cent.

5. Chicago & Northwestern, Kinzie street, Chicago. Old Shops, 25 erecting pits, 14 boiler tracks. Total equipment, 1,060 engines; engine pit ratio, 2.4 per cent. Published statement says that there are about 1,070 engines, and the boiler repairs are concentrated for 1,185 engines. This company is now looking into the question of obtaining additional pit capacity.

(*Concluded from page 245.)

6. Chicago Great Western, Oelwein, Ia., 1898, 15 erecting pits, four boiler tracks. Total equipment, 209, practically all concentrated at Oelwein, which is the junction of three divisions. Engine pit ratio, 7.1 per cent.

7. Colorado Southern, Denver, Col., 1900, 9 erecting pits. Total equipment, 173 engines. Published statement states that this shop is expected to take care of 144 engines, or engine pit ratio, 6.3 per cent.

8. Ohio & Mississippi, Washington, Ind. Old Shops; 8 erecting pits. Published statement, shop to take care of 100 engines, or engine pit ratio, 8 per cent.

9. Oregon Short Line, Pocatello, Idaho, 1902, 10 erecting pits. Total equipment, 177 engines. Assumed all concentrated at Pocatello; engine pit ratio, 5.7 per cent.

10. Southern, Sheffield, Ala., 1902, five erecting pits. Published statement, shop to take care of 80 engines. Engine pit ratio, 6.3 per cent.

11. Minneapolis & St. Louis, Cedar Lake, Minneapolis. Old Shops, extended 1902. Engine pits, 10. Total equipment, 76 engines. Published statement, shop to take care of 80 engines. Engine pit ratio, 13.2 per cent.

12. Louisville, New Albany & Chicago (now Chicago, Indianapolis & Louisville), Lafayette, Ind., 1895. Engine pits, nine. Total equipment, 93 engines. Engine pit ratio, 9.7 per cent.

13. Wisconsin Central, Fond du Lac, Wis., 1901. Engine pits, 15. Total equipment, 157 engines. Published statement, shops to take care of 150 engines. Engine pit ratio, 10 per cent.

14. Missouri Pacific, Baring Cross, Ark., 1901. Engine pits, 24, of which 15 are assigned to engines and nine to boilers. Published statement says that about 90 per cent. of 210 engines in that territory, or 189 engines, are repaired at Baring Cross. Engine pit ratio, 8 per cent.

15. New York Central. Total equipment as per equipment list, 1,368 engines. Total of 122 engine pits on system, or engine pit ratio, 8.9 per cent. Published statement, 1,461 engines on system, or pit ratio, 8.3 per cent. Over 250 round house pits have been built within recent years, and the system of small machine shops at round houses for taking care of comparatively heavy repairs is very fully developed, thereby relieving the repair shops.

16. Philadelphia & Reading. Total equipment, 951 engines. Main locomotive shops at Reading, Pa., built in 1901; 70 erecting pits. Expected eventually to take care of the heavy repairs of practically the entire equipment of 951 engines in 1902, making the pit ratio 7.4 per cent. As some engines will be taken care of elsewhere, the true pit ratio is probably about 8 per cent. Published statement says that eventually this shop is expected to take care of 1,000 engines, or pit ratio, 7 per cent.

17. Central of New Jersey. Total equipment, 476 engines. Main locomotive shop, Elizabethport, N. J. Built 1901. Longitudinal shop, 700 ft. long, of which 500 ft. is expected to be used for engines and 200 ft. for boilers and tanks. There are also locomotive shops at Ashley, Pa., which have six pits in the main shop and six pits assigned for repair work in the round house, making 12 pits. The two shops give a total of 37 pits for 476 engines, or engine pit ratio, 7.8 per cent.

18. Delaware, Lackawanna & Western. Total equipment, 654 engines, of which a large number are new engines bought within recent years, hence for the present repairs are not as heavy as they will be in several years. The present engine pit ratio is 7.5 per cent. In addition, considerable comparatively heavy work is done at a number of round houses where there are drop pits. This company has certain improvements under way which will give an engine pit ratio of 8.7 per cent. on the basis of present engine equipment. Allowing for regular increase of engines, the ratio will probably not drop below 8 per cent. for at least five years after the improvements are completed.

19. The annual statement of one of the prominent Eastern trunk lines states that, in comparison with engines concentrating and taken care of at the various shops, the pit ratios at the several shops were 8.4 per cent., 10.4 per cent., and 10.9 per cent. The actual average number of engines assigned to each territory and shopped at one time proved to have been at the same shops respectively 8 per cent., 10.4 per cent. and 9.1 per cent.

The pit ratio, while valuable, is not absolutely conclusive as to the actual work that can be done, as the fact of having erecting pits for storage purposes, so to say, is not indicative of shop output, which depends on the machine equipment, boiler work facilities and crane service, and on the class of engines and the road service.

Practice indicates that the number of erecting pits is from 6 to 10 per cent. of the number of engines taken care of, and that an engine pit ratio of about 8 per cent. is the average practice. The desirable theoretical ratio is frequently set at 10 per cent., but few roads have succeeded in holding this ratio. In most cases a large number of comparatively heavy repairs are made at roundhouses, so that the roads get along with less pits and shop equipment than desirable and economical.

In order to ascertain the number of engines that can be taken care of on a given number of pits, it is necessary to make some assumption from practice as to the length of time required to overhaul an engine and also to make light repairs. With a pit ratio of 8.33 per cent. or $^1/_{12}$ of the equipment in the shops at the same time, and if each engine required one month a year for light and heavy repairs, the entire equipment could be put through the shop in one year. Motive power men usually claim that every engine should be shopped once a year for light repairs, from three to six days, and once every 12 to 18 months for general overhauling, the time required for the latter work being placed at from three to five weeks. It is also claimed that in modern plants an engine can be overhauled and receive general repairs in less than three weeks, dependent upon the shop equipment and the size of the engine. This question, therefore, is largely one of assumptions.

The proper method would seem to be to settle the number of pit days required per year for all light repairs at

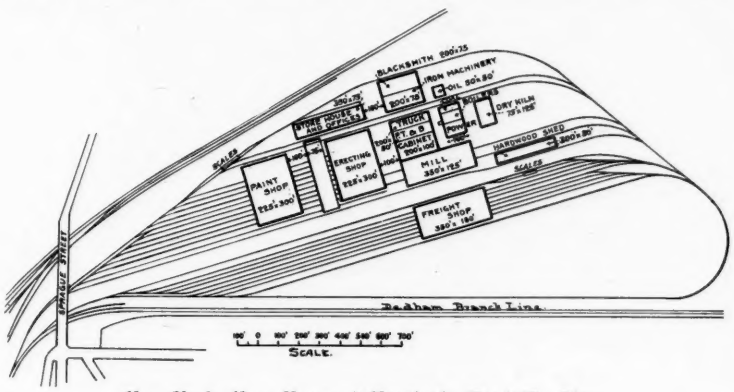
the regular shop erecting pits, making allowance for work done at small division shops or roundhouses. Deduct this figure from the total available regular shop erecting pit yearly working days, and the balance will represent the shop pit working days per year available for heavy work. Assume the average number of pit days required to overhaul one engine, and the number of engines that can be cared for is easily established. The ratio of the number of engines that can be taken care of per year in relation to the full equipment will allow the average time to be settled that an engine has to remain out of the shops for a given equipment and a certain number of shop erecting pits.

As stated above, it is usually assumed where the service is heavy that every engine is shopped once a year for light repairs, and once a year for heavy repairs, but in practice few roads are able to live up to this rule. On many roads the engines are expected to stay out of the shop a year and a half or longer before requiring general repairs. Comparisons of the time assumptions on different railroads are not reliable owing to the varying conditions, as it is obvious that a heavy engine making a large mileage, with heavy tonnage, fast speed, long grades, bad water, etc., will run down and wear out sooner than a light engine hauling light trains under favorable conditions. The time assumption as to the average frequency of shopping engines must be established for each individual railroad or district of a railroad system.

Layout of Passenger Car Repair Shops.—From a review of examples of passenger car repair shops there is only one possible decision to reach, and that is that in almost all instances a transfer table is used.

A passenger car repair shop has the following main departments, viz.: Erecting or main shop, paint shop, paint storehouse, cabinet shop, upholstering shop, tinshop, carpenter shop, planing mill, storehouse, shed for finished or hardwood lumber, lumber yards, etc. In some cases there is a special passenger car truck shop. Such machine and blacksmith work as has to be done is usually attended to in the shops provided for such work in connection with the entire shop plant, as there are no cases known where a railroad passenger car repair shop is a separate plant.

There is no special rule in regard to the relative size of the various sub-departments and total floor space required in relation to the total passenger equipment of a road. Local conditions and requirements make this practically impossible to establish. In any new layout the conditions and proportions of existing shops should be studied and conclusions drawn therefrom.



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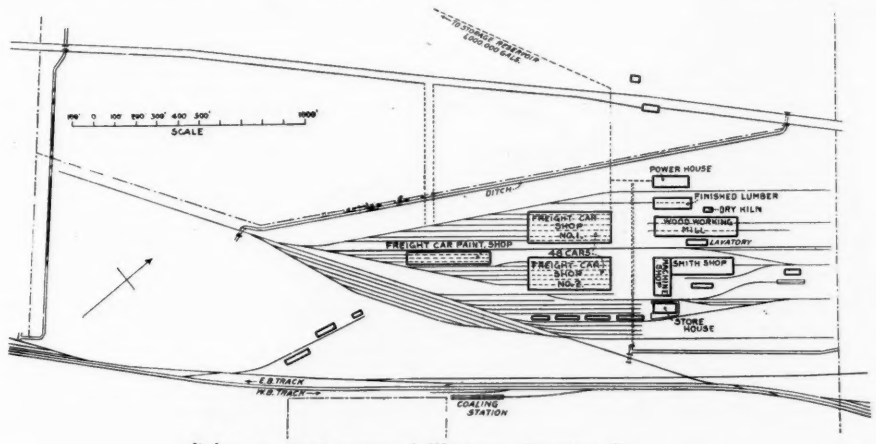

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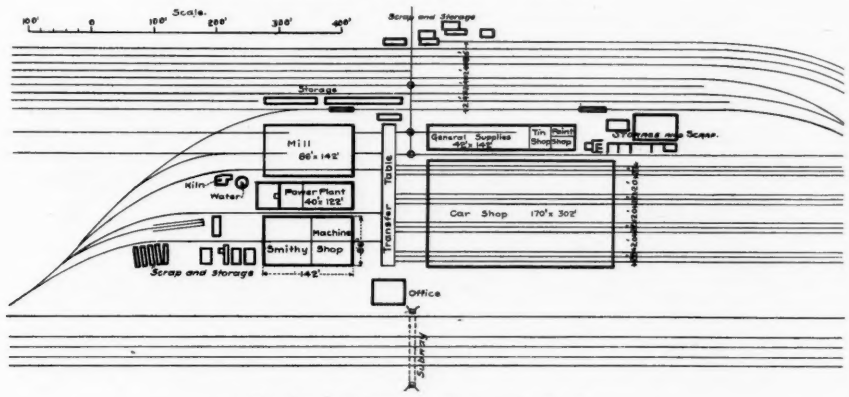
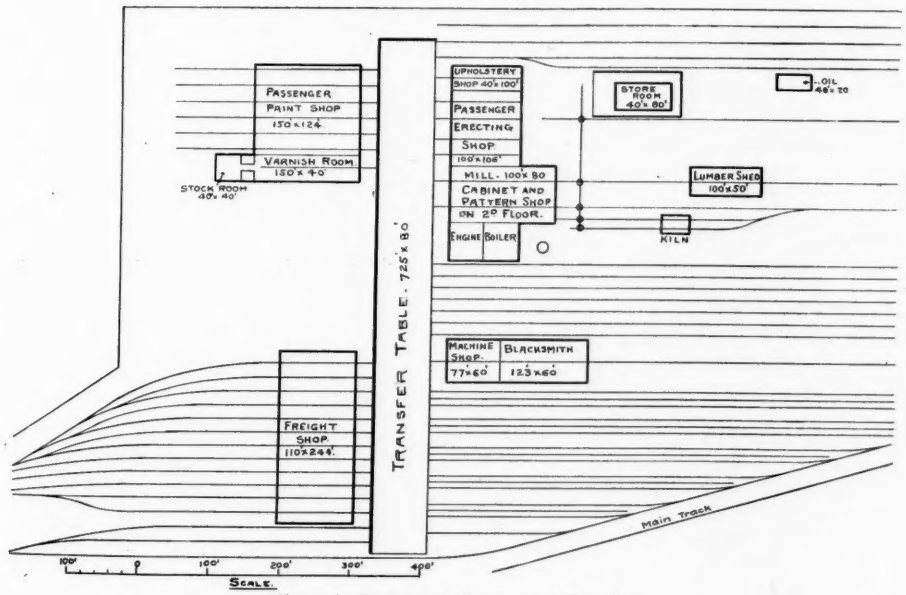


Merchants Despatch—Despatch, N. Y.



Missouri, Kansas & Texas—Sedalia, Mo.

Car Shops.

Layout of Freight Car Repair Shops.—From examples of existing freight car repair shops the prevailing practice for heavy repair work is to have a longitudinal building, i.e., run tracks through a building. The tracks are connected to yard leaders and thus form a car repair yard at each end of the building. In some cases, where the tracks are long, or one end of the property does not afford room for a yard approach to the house, a large number of designs introduce an auxiliary transfer table to facilitate moving cars in or out of the house and also to transfer materials back and forth.

For light repairs a series of long, parallel tracks connected at each end to yard leaders is in general use. These tracks should be convenient to the main car shop, planing mill, lumber yard and general stores for the car department and have space left for storage of working supplies.

A freight car repair plant covers the following facilities, viz.: Erecting or main freight car shop, planing mill, dry kiln, lumber shed, iron shed, scrap bins, etc. Also machine shop, blacksmith shop, wheel shop, pattern shop, general storehouse, power plant, etc., all of which are generally not specially assigned to the freight car department, but used conjointly for all departments of the entire plant. There is also in some cases a special freight car truck shop.

A new departure, already inaugurated on a very small number of roads, is a special shop for repairs of steel cars, with proper appliances for lifting and the necessary special tools, forges, furnaces, etc. There is no doubt that this will be an important sub-department in the future. It is probable that power cranes and hoists of various kinds will be used more in the future, even in connection with the repairs of wooden freight cars.

There is nothing very difficult in the designing of freight car shops, except the layout of the various buildings, planing mill and material yards so as to get the machines, working tracks and supply tracks in such relation to each other that the material will pass through the shops in the natural sequence of the work. It is also necessary to take care of the sawdust and shavings.

The only remaining point is the question of track spacing and it is the most important element of the track layout, both for the light repair yard and the car shop proper, and also the disposition of light narrow gage material tracks between the car tracks, cross tracks with turntables at proper places, or mechanical transfer devices. turntables at proper places, or mechanical transfer de-

One system is to space all the tracks for light repairs from 16 to 20 ft. centers, and for heavy repairs and inside the shop from 20 to 22 ft. centers, with narrow gage material tracks in each space between tracks. Another system is to group the track in pairs, about 16 to 20 ft. centers, and leave a wide passageway, 20 to 26 ft. centers, between each group, with a narrow gauge service track down the passageway. A third system is to space all tracks evenly, about 20 to 22 ft. centers, and run narrow-gauge tracks in every alternate space.

Many of the recent freight car shop designs have adopted the uneven spacing and grouping of tracks in pairs, viz.: Merchants' Despatch car shops at Despatch, N. Y., 1897; Missouri, Kansas & Texas, Sedalia, Mo., 1898; Central of New Jersey at Elizabethport, N. J., 1901; New York Central at Oak Grove, Pa., 1902; and Pittsburgh & Lake Erie, McKee's Rocks, Pa., 1902.

On the other hand, the even spacing has been recently adopted at the New York, New Haven & Hartford main car shops, Readville, Mass., 1901; Delaware, Lackawanna & Western main car shops, Scranton, Pa., 1902; Union Pacific, Omaha, Neb., 1902; Atchison, Topeka & Santa Fe., Topeka, Kan., 1902; and Canadian Pacific, Montreal, Canada, 1902.

General Shop Storehouses.—The general storehouse for a large repair shop should be central to all departments and close to the principal departments requiring supplies. It should be connected by tracks or conveying facilities with all important departments.

Provision must be made for unloading cars with material for the storehouse and for switching and storage of other cars. Much material can be handled and stored on open platforms surrounding or adjoining the storehouse, although the tendency is especially marked in industrial plants to store all materials under cover. There should also be a number of sheds or open platforms throughout the plant, adjacent to the main buildings, such as iron sheds, lumber sheds, lumber yard, scrap bins, etc., which will be under the control of the shop storehouse department although separated from the main storehouse.

Storehouses are usually built two stories high, as there is a large amount of small material that can be stored in an upper story. Platform elevators are provided for this purpose.

In regard to class of structure, it would seem very important to make this building fireproof, yet actual practice indicates that, while brick buildings are used, the interior construction is timber, in some cases "slow burning mill construction," but generally ordinary timber construction. Many shops have small model fireproof structures for storage of patterns, but the fireproofing of the main storehouse has been omitted, presumably as a matter of economy. As explained by one official at an important new shop plant, all the attention was given at the start to the main buildings and when the storehouse was taken up money was running short and economies were necessary.

The general office of the shops is usually connected with the storehouse, built at one end of the building or on the second floor. This is not good practice, as it introduces additional fire risk. It is preferable to build a separate office. For similar reasons separate storehouses for oil, paint, varnish, etc., are always built and located so as to reduce the fire risk as much as possible.

It is difficult to establish any rule as to the proper size of a storehouse, as the conditions vary at each plant and in many cases the shop storehouse serves as a general storehouse for road and division supplies.

Power and Power Plant.—In regard to the power for a large repair shop, it is conceded that electricity should be used. The testimony as to its successful installation and operation at so many plants, not only at industrial works, but also for railroad companies, should be conclusive.

Whether to use the direct or alternating current seems to be the only main question left open for discussion. There are prominent examples of both systems and strong advocates for each. The final selection depends on the special conditions and largely on the views of the electrical expert employed to design the plant. The general tendency would seem to favor the alternating current for large plants, owing to its flexibility and greater distance range.

In regard to machine driving with electricity, the question is whether to use a separate motor for each machine or to group the machines and drive from short sections of shafting. There are extremists in both cases and plants have been turned out all group driven and others with all individual motors. The best and most conservative practice is to follow the lead of the majority of the plants and introduce a judicious combination of individual and group driving. In this case the only question open for discussion is the degree to which the group driving shall be extended, or, in other words, the minimum size of motors. The limit would seem to be, at the present state of the art, to use no motors smaller than 5 h.p.

Practice has also indicated absolutely that it is economy at large plants to centralize all steam and electric generating machines for power and lighting, together with air compressors, pumps, water pumps, etc., in one central power house.

The committee of the American Railway Master Mechanics' Association in 1900 on the subject, "Power Transmission by Shafting vs. Electricity," reached the following conclusions:

"1. In a small shop, consisting practically of one building, having an equipment of small tools for light work only, electric transmission will not be found a paying investment. In such a shop, however, an electric lighting dynamo will be a convenience, and may be utilized to run a few labor-saving electric tools, such as cylinder boring outfit, a turntable motor, etc.

"2. In an extensive shop plant the installation of a central power station and electric transmission will always be found advisable, as it will not only result in the most economical system in respect to operation, but will make possible far more important shop economies, namely, an increase in quantity and quality of output and a reduction in cost of handling the same."

The power station should allow for all reasonable future requirements and the mechanical arrangements for handling coal and ashes, pipe ducts, etc., should be arranged with this in view.

Machinery, Tools and Overhead Cranes.—In railroad repair shops the question is not only to make the repairs economically, but also with speed, i.e., to get the equipment back into service, thereby not only releasing tied-up capital and restoring its earning power, but also enabling the railroad company to handle its business efficiently and promptly.

Ample machine equipment of a shop is the principal feature to insure prompt return of engines into service. On most railroads the machine equipment at the shops is inadequate or antiquated. In this respect railroad companies are far behind manufacturing plants. The success of American manufacturers over British concerns is largely attributed to the prevailing practice of American manufacturers to always have the best machinery and appliances, even if they have to scrap comparatively new machines.

The committee of the American Railway Master Mechanics' Association appointed to report in 1898 on the subject of "Advantage of Improved Tools for Railroad Shops" stated:

"We find that where a careful selection and proper application has been made of improved tools in shops, the saving in time over the old methods of getting out the same class of work is so great as to set aside all doubt.

"Rapid strides have been made in the invention and introduction of powerful and convenient motors having electricity and compressed air to actuate them and their extended use in connection with the latest improved tools designed to work with them is strongly urged by your committee."

The speed of output of a locomotive repair shop is regulated mainly by the machine department. Unless this department is well equipped and of proper size, locomotives will be constantly waiting to get into the shop, or, if there are sufficient erecting pits, will simply be stored, so to say, in the house in place of out in the open. Increased pit capacity does not mean increased shop output, unless the machine shop is able to respond to a rush and has ample equipment to keep repairs of engines on all the pits going simultaneously. It might be stated as an axiom that it is preferable to have too little pit capacity and too much machine capacity than the reverse.

Of course, the special machines in all departments must be properly balanced with reference to the expected total shop output, but, as a rule, in existing railroad shops the equipment of the machine shop is not up to the requirements of the erecting shop and engines are kept waiting for machined parts.

There are no existing general rules as to the proportion of tools of various kinds with relation to the work in different departments. This must in each case be established by observation of similar work in existing plants and suitable estimates of the new requirements.

The number of "tools per pit," i.e., number of tools in the machine shops per erecting pit, is frequently referred to as the measure of the machine facilities, compared with the erecting shop. Unless it is exactly stated by some clear definition what constitutes a separate machine tool and how to rate new and old tools, this unit of comparison is very uncertain. The proportion runs in different plants from about four to 13 tools per pit. In some very well-known shops, where the proportion is over 10 tools per pit, it is known that the machine shop never delays the work. If equipment is not to be tied up in the shop, waiting for machine work, it is necessary to instal an excess of machinery, if anything, so as to cover all possibilities and be able to meet the strain of rush times.

In preparing a list of machine tools for a proposed large locomotive repair shop of an Eastern trunk line, the following proportions were established after a very careful study of the subject. While the list is somewhat dependent on the personal equation of the motive power official, still the results arrived at will be of interest, viz.:

Cutting tools, 26 per cent.; turning tools, 52 per cent.; drills, 13 per cent.; miscellaneous, 9 per cent. Total, 100 per cent.

The cutting tools were sub-divided as follows: Planers, 50 per cent.; shapers, 20 per cent.; slotters, 20 per cent.; milling, 10 per cent. Total, 100 per cent.

The turning tools were sub-divided as follows: Lathes, 80 per cent.; boring mills, 15 per cent.; grinding, 5 per cent. Total, 100 per cent.

Owing to the recent advancement in the manufacture of tool steels and the more rigid construction of special machines for using such improved steels at higher speeds and with a greater range of variability in speeds, it can be reasonably assumed that the output from a given number of modern machines properly equipped and driven will be larger than in the older class of shop tools usually found in railroad shops. The assumptions as to increased output per machine unit must, however, be conservative and ascertained from a practical view of shop operations. The increased speed or depth of cut of a modern machine does not necessarily mean increased output in units, as the increased size of the locomotive parts to be machined, as compared with the smaller parts of older rolling stock, may require all of the increased efficiency of the new tool to turn out one part in the same time as on the old machine. Thus to turn a 10-in. axle will require a more efficient machine than to turn an old-style 7-in. axle in the same time on an old machine, and yet the output of the machine in each case is one axle. Similarly, the increased power of a 400-ton wheelpress, as compared with, say, a 200-ton wheelpress, does not necessarily affect the output, which is simply one wheel, the difference being in the size of the part handled. That a note of warning is necessary not to hastily assume that heavier and speedier tools mean invariably increased output is indicated by the fact that an experienced shop designer advocated recently the cutting down of machine shop space to two-thirds the proportion in older layouts owing to the expected increased output per machine. Such sweeping assumptions will not hold, taking all classes of machinery and shop operations into account.

Finally, attention should be called to the necessity of introducing the best labor-saving contrivances for reducing the cost of handling heavy parts, not only in the erecting shop, but in the machine shop, boiler shop and around the shops and yard. Manufacturing plants generally, and also British and Continental railroad shops, are far ahead of the general American practice in this respect. During the last 15 years, however, compressed air appliances and electric cranes have been largely introduced in American railroad shops, and it is gratifying to see the growing tendency in this direction, so that to-day a shop is not considered up to date unless it has electric overhead cranes, pneumatic hoists and transfer and lifting devices at every desirable point in the buildings and shop yards.

Structural Work of Buildings.—Generally speaking, for large shop buildings brick walls are preferred, although where a steel skeleton structure is required for the support of high roofs or heavy crane runways and an abundance of side light is essential, so that the brick walls are simply curtain walls between the steel supports, then it is very desirable to consider carefully the merits of the so-called "factory plan" of using all iron and glass side walls. In such a case the brick side walls stop at the lower window sill. In many cases, especially in industrial plants, panels or horizontal bands of the side walls between the windows are covered with concrete slabs fastened to the steel frame, making a cheaper although not as ornamental a construction as brick filling supported on an iron frame. The Erie at Dunmore, Pa., and the Central of New Jersey at Elizabethport, N. J., have recently built all concrete shop buildings.

The foundation walls should be concrete or rubble masonry, roof should be structural steel and the sheathing of boards, or, preferably, reinforced concrete slabs. Roofing for flat roofs should be preferably a first-class grade of tar and gravel or slag roofing in preference to tin; on steep slopes slate is better than tin or tile.

The floor in boiler, blacksmith, casting and similar departments should be cinders, and in all other buildings wood on concrete bed. Where rough work is done, use yellow pine or oak plank, but for a first-class shop, like a machine shop, coach shop and even in the erecting shop, a top floor of maple is being used very extensively in sections of the country where a second-grade maple flooring is comparatively cheap. The concrete is frequently a tar concrete; in other cases a layer of tar or tar and sand mixture on top of stone or cinder concrete is used as a damp course under the floor planks. Boiler room floors should be preferably brick or concrete and paint shop floors concrete or asphalt.

Concrete floors are used at some shop systems with good results. The top should be wood floated, not metal floated. Concrete floors should not be used where men have to stand at benches or machines. Wood floors are preferable at such points or wooden racks on top of the concrete floor.

In regard to fire insurance, it will be found on investigation that practically fireproof rating can be obtained in all metal-working shops with brick walls, unprotected iron columns and trusses, solid plank floors on concrete sand or cinder bed, even if windows and doors are of wood, provided wooden purlins and roof sheathing are not used; in other words, provided tiling, re-enforced concrete or hollow brick are laid on the iron roof framing direct. This will increase the roof load and the cost, and estimates should be made to ascertain whether the decreased premium payment for the building and contents would offset the increased interest on the first cost.

It is not merely a question of whether the railroad company can cover itself by insurance for direct loss by fire, but the safer structure will protect the company from indirect losses, such as interference with its business while adjusting a fire loss and rebuilding, loss of equipment and machinery that cannot be readily replaced, etc. The arguments in favor of first-class fireproof construction are particularly pertinent for companies who carry their own fire risks.

A timber roof covering offers a large area for a fire to spread, and it is very difficult to stop. Similarly there is considerable fire risk even in a solidly bedded timber floor, in case it gets oil-soaked. A fire once started on the floor would spread rapidly. Intercepting strips of concrete, as, for instance, the use of concrete between the rails of tracks inside of the building, have been advocated so as to confine fires running along oil-soaked floors to certain restricted zones.

Where the contents of a shop are of a combustible nature, such as in car shops, planing mills, etc., the use of fireproof construction is less marked. In some cases "mill construction" will be warranted and will assist in reducing the insurance premium. Sprinkling systems, on which insurance companies lay so much stress, are practically ineffective in large, high, one-story shop buildings, especially where the upper space has to be left clear for crane service.

In designing roof spans, etc., care should be taken to specify exactly what weights it may be desired to hang from the trusses.

In regard to lighting, dependent on conditions, the glass for side lights are double-thick plain glass or fine-ribbed "factory glass" to break the direct rays of the sun. Skylights and monitor glazing are generally wired glass. Wire netting underneath glass is not a desirable construction. Recently at a number of large plants "translucent fabric" has been used for top lights. The lighting at night is done by means of arc lights for general illumination and incandescent lamps for individual lighting.

Heating in almost all large industrial, municipal and railroad buildings is generally done by the hot-blast system, in which fans draw or throw air across heating coils, heated by exhaust steam from the central power plant, and the heated air is conveyed by ducts, suspended from the roof or placed underground. There are, however, a number of large plants using the hot water system, notably the immense new plant of the Allis-Chalmers Company at West Milwaukee. For smaller buildings and offices heating by direct radiation is used.

Additional structural features requiring attention are the sewerage, sub-soil drainage, so as to draw the water from around the pits and underground ducts and pipe passages; water supply, fire protection appliances, ventilation, sanitary arrangements, closets, lavatories, lockers, piping distribution for hot water, compressed air, wiring, removal of smoke at testing pits, removal of sawdust and shavings in woodworking departments, etc.

Finally the architectural treatment should be neat and plain, corresponding to the character of the various buildings. Minor architectural embellishments and details are out of place and not warranted.

Auxiliary Features and Appliances.—Tracks should not only be supplied for the actual working tracks, but all parts of the plant should be brought under one general track scheme, so as to facilitate and simplify all movements. In some parts of the plant narrow-gage tracks for push car service will be required. But, in general, the main shop tracks for moving materials on cars should be preferably standard gage.

The only class of switching engine that should be used around a large shop plant is an electric storage or a compressed air locomotive, thereby reducing all risk from fire and allowing these engines to run freely in the lumber yard or inside the buildings, and permitting very short curves to be turned.

Ample yard tracks should be provided for storing crippled cars or engines waiting to be repaired and for condemned equipment.

It is desirable to settle in the preparation of the

general scheme where lumber yards, scrap bins, miscellaneous storage of old materials, etc., are to be located and to allow ample space for such purposes. The shop grounds should be enclosed by a fence, with entrances for the men.

There should be good wagon roads throughout the principal passageways between the shops, all track crossings boarded over, so as to enable wagon deliveries to be made at the various shop buildings, but more particularly so as to allow of the free passage of local fire engines in case of fire. This is a provision that is neglected at many shops, even where there is an organized local fire department. Fire hydrants and hose-cart houses should be scattered liberally throughout the plant.

Finally it is desirable to urge once more the importance of having the entire layout of buildings and yard facilities capable of easy extension from time to time, and, further, that it is seldom that a railroad company finds it has too much land on hand. Ample land should be bought in the start before improvements on adjoining properties spring up and make it impossible to make additional purchases.

TECHNICAL.

Manufacturing and Business.

The Bogart Car Co., of Chicago, Ill., has been incorporated with $25,000 capital to build and operate stock cars, refrigerator cars, etc.

Harry A. Norton, of Boston, Mass., sailed April 7 for Russia, where the Norton Ball Bearing Jacks are now being extensively introduced.

The Rohman Automatic Car Co., capital $100,000, has been incorporated in New Jersey by Dr. W. D. Rohman, Chas. Maxwell and Louis Stotorno.

The Chicago Car Heating Company, Chicago, capital $100,000, has been incorporated by James H. Raymond, Otto R. Barnett and Frank H. Drury.

F. E. McKee, formerly Electrical Engineer for the Chicago & Alton, has been made Chief Electrician of the McKees Rocks plant of the Pressed Steel Car Co.

The Sterlingworth Railway Supply Co. has completed plans for additions to its malleable department at Easton, Pa., increasing its present capacity 5,000 tons per annum.

The Continental Equipment Co. has been incorporated in New Jersey by McKinley Boyle, H. D. Newton and Benjamin T. Gilbert, to deal in railroad and contractors' supplies.

The J. W. Edwards Construction Co. has been incorporated by Geo. L. Dayton, Robert Ferrier, Jr., and David F. Edwards, of Jersey City, N. J., to build and repair railroads.

The Columbus Steel Rolling Shutter Co., Columbus, Ohio, has recently received orders for steel rolling doors and shutters for 58 openings; 23 from Flaherty & Co., Dayton, Ohio, and 16 from C. P. Findley, St. Louis, Mo.

Sylvester Hogan, formerly connected with the New York Belting and Packing Co., New York, has made a connection with G. S. Wood & Co., Great Northern Building, Chicago, manufacturers of high grade mechanical goods.

The Waugh Draft Gear Company, Chicago, has been incorporated with a capital of $100,000 to manufacture and sell railroad appliances and steel underframes for cars. The incorporators are James M. Waugh, Albert N. Eastman and Frank White.

The South Atlantic Car & Mfg. Co., $100,000 capital, has been organized at Waycross, Ga., with the following officers: Geo. Dole Wadley, President; W. A. Price, First Vice-President; F. H. McGee, Second Vice-President and General Manager, and H. H. Burnett, Secretary and Treasurer.

J. B. d'Homergue, Manager of a department of the H. W. Johns-Manville Co., 100 William street, New York City, sailed on March 30 for England, where he will make an investigation of the trade for asbestos and sound-deadening materials in that country.

The Stanley Electric Mfg. Company has sold to the Indianapolis, Columbus & Southern Railway Company the following apparatus: Forty-eight type No. 402 railroad motors, one 500 k.w. revolving field generator, one 300 k.w. rotary converter, three 110 k.w. and three 150 k.w. transformers and the necessary switchboard apparatus.

The American Steam Gage & Valve Mfg. Co. and the Mowry & Phillips Co. have become merged under the corporate name of the American Steam Gage & Valve Mfg. Co., with the following officers: John McCandlish, President; M. Briggs Phillips, Vice-President; R. B. Phillips, Secretary; J. L. Weeks, Treasurer and General Manager.

G. S. Wood & Co., Chicago, makers of the "Acme" car vestibule diaphragm, have opened an eastern office at 39 Cortlandt street, New York, in charge of Fred F. Bennett, General Eastern Sales Agent. Mr. Bennett is well-known in railroad circles not only through his connection with this company but by reason of his long connection with railroad journals, the American Steel Casting Company, and the Chicago Pneumatic Tool Company.

The Stanley Electric Mfg. Company, of Pittsfield, Mass., has elected officers as follows: President, W. Murray Crane, Pittsfield; First Vice-President, Dr. F. A. C. Perrine, Pittsfield; Second Vice-President, M. D. Barr, New York; Third Vice-President, S. N. Hammill, New York; Treasurer, W. W. Gamwell, Pittsfield; Assistant Treasurer, R. S. Murray, Pittsfield; Secretary, W. S. Westover, New York; Assistant Secretary, A. G. Davis, New York.

Iron and Steel.

The Railway Specialty Co. of Canada has been organized at Bayside, N. B., to make construction material for railroads and bridges.

The Chelmsford Foundry Co. has been incorporated at Augusta, Me., with $300,000 capital. Joseph Cavanagh is named as President, and Henry T. Ripley, Treasurer.

The Carnegie Steel Co., National Steel Co. and American Steel Hoop Co. have filed a merger agreement under the laws of New Jersey to transact business under the name of the Carnegie Steel Company.

The American Coke & Gas Construction Co., with $400,000 capital, has been incorporated at Jersey City, N. J., by Louis B. Dailey, Warren Nakers and Joseph M. Mitchell, to make iron and steel, and build bridges, railroads, and coke, gas and chemical works.

The Wellman-Seaver-Morgan Engineering Co., of Cleveland, Ohio, and the Webster, Camp & Lane Co., of Akron, have consolidated with $3,000,000 capital, under the name of the former. The officers of the new company are: S. T. Wellman, President; John McGregor, Chairman of Board of Directors; S. H. Pitkin, First Vice-President; John W. Seaver, Second Vice-President; Geo. H. Hulett, Third Vice-President; Chas. H. Wellman, General Manager; Thomas R. Morgan, Secretary; Albert D. Hatfield, Treasurer.

Purifying Water for Locomotive Boilers.

The Chicago & North Western purifying system was described in the *Railroad Gazette*, February 27, and was criticized by a correspondent in the issue for March 20. The critic mistook it for one of the "systems wherein the settling of the precipitate takes place in the same tank where the mixing occurs," whereas the mixing of the chemical and water is in the "tipper," and from this the treated water is discharged into the settling tank. There was one other error: The loss of water in treatment is not 22 per cent.; it is less than one-half of 1 per cent. This error grew out of a statement of tank "capacity," compared with the amount of soft water produced.

Signaling Standards in Texas.

The Texas Interlocking Association, an organization of railroad signal engineers formed since the passage of the law in that State requiring the immediate signaling of a considerable number of crossings, has adopted a standard three-light casting for semaphore blades and a four-foot blade. The Association expects to prepare and adopt a set of standard specifications so as to unify the designs of as many castings as possible and reduce their number. The State Railroad Commission has ruled that the all-clear indication in interlocked signals at crossings at night shall be green, with yellow for the adverse indication in distant signals. This rule is, of course, being carried out, and it seems likely that it will result very soon in the adoption of green throughout the whole of those railroads which have signalled crossings, and which, therefore, have to comply with the Commission's order.

The Demand for Talented Men.

The Engineering Agency, Monadnock Block, Chicago, received applications in one day last week for 67 high-grade technical men; one company asking for 25 blast furnace draftsmen at $125 to $150 a month and another company for 30 structural draftsmen at $125 a month.

The agency has vacancies on its books for over 200 competent men, including instructors in shop work for technical colleges, teacher for manual training school, assistant editor for technical journal, chemists, engineers of all kinds, shop superintendents, draftsmen, etc. It has special facilities for placing any good technical man in just the position for which he is best fitted and in that section of the country where he prefers to work. Over 5,000 men have been so placed by it during the past 10 years. The officers of the agency are: President, F. A. Peckham, for 12 years with *Engineering News;* Treasurer, A. B. Gilbert, for 11 years with *Engineering News;* Secretary, A. G. Frost.

Effect of Steam for Atomizing Oil.

There is quite a widespread misconception regarding the part that the steam which is used for atomizing purposes plays in effecting combustion. It is supposed by many that after atomizing the oil the steam is decomposed and that the hydrogen and carbon are again united, thus producing heat and adding to the heat value of the fuel. While it may be true that the presence of steam may change the character and sequence of the chemical reaction, and result in the production of a higher temperature at some part of the flame, such an advantage will be offset by lower temperatures elsewhere between the grate and the base of the stack. All steam that enters the furnace will, if combustion is complete, pass up the stack as steam, also carrying with it a certain quantity of waste heat. The quantity of available heat, measured in thermal units, is undoubtedly diminished by the introduction of steam. In an efficient boiler it is quantity of heat rather than intensity that is wanted.—*From the report of the "Liquid Fuel" board of the U. S. Navy.*

THE SCRAP HEAP.

Notes.

On the Putnam Division of the New York Central in the month of March, 99.73 per cent. of the trains were on time. Out of 3,400 passenger trains handled, only 11 were late. The officers think that this record has never been surpassed.

Press despatches of April 5 report that throughout the main line of the Pennsylvania Railroad east of Pittsburg the movement of freight other than live stock and perishable goods was almost entirely suspended throughout the day (Sunday).

On April 15 the Supreme Court in New York City will take up for trial the case of John M. Wisker, the engineman of the train of the New York Central which was in collision with one of the New York, New Haven & Hartford in the tunnel in New York City, Jan. 8, 1902, killing 17 passengers.

The Pennsylvania Railroad has announced an advance of 10 cents a ton on the rates for carrying coal to Buffalo, and in connection with the announcement it is stated that the destination of cars of coal will not hereafter be changed without the payment of local rates from the point where the change is made; moreover, any accrued charges for demurrage will have to be paid before the coal is forwarded.

The result of the negotiations between the New York, New Haven & Hartford with its trainmen is said to be a substantial increase in pay, but nothing official is given out as to the amount or percentage of increase. It appears that the most important change is the adoption of a rule allowing overtime after 10½ hours, instead of after 12 hours, as formerly. Yard conductors and brakemen received a considerable increase.

A press despatch from St. Louis April 6 says that the Wabash Railroad has concluded its negotiations with employees regarding wages. West of the Mississippi River the desired increase was granted several weeks ago; 12 per cent. for conductors, brakemen and baggagemen in the passenger service, and 15 per cent. for conductors and brakemen in freight service. East of the Mississippi the rates will be made as high as those of competing lines. It is proclaimed that the brotherhoods have won a victory, but nothing is said in the despatch about the amount of the increase east of the river or whether there will be any general increase. The firemen have received some increase on the Canada Division, to put them on a level with the firemen of the Canadian Division of the Michigan Central. The firemen throughout the Wabash lines will enjoy improved conditions. Some yardmen will receive a substantial increase.

Ornamental Trees on the Union Pacific.

The Union Pacific has sent out a carload of trees and shrubs to be planted at the station parks on the Kansas City-Denver line. This material comes from the Kansas Home Nursery of Lawrence and consists of a variety of ornamental trees and shrubs, among them a fine lot of catalpa bungei—umbrella catalpa. The work is in charge of Edward Yewdall, of Lawrence.

Price of Southern Iron Reduced.

A reduction of $1 per ton in the price of Southern iron was announced April 1, which makes the basis $16.50 for No. 2 foundry at furnace. The freight charge of $4.25 additional makes the price $20.75 per ton, which is 25 cents less than the quotation at the seaboard for German iron of a similar grade. The exports of steel and iron from Germany to the United States were much greater in 1902 than in 1901, and it would appear, therefore, that the present cut is an attempt to drive the German iron out of the competition.

Cotton Crop of 1902.

The completed figures obtained by the Census Office give the total cotton yield of the United States at 11,078,882 commercial bales, equivalent to 10,630,945 standard bales of 500 lbs. each. The distribution of production shows Texas considerably in the lead with an output equal to 2,498,013 500-lb. bales. Mississippi is second with 1,443,740 bales, and Georgia third with 1,425,044 bales. There were no other States which produced more than 1,000,000 bales, although Alabama, Arkansas and South Carolina produced over 900,000.

The Amendment to the Charter of the Steamship Combine.

The International Mercantile Marine Company on April 1 filed papers amending its original charter. There is a clause authorizing the company to enter into a contract with the United States government, or any State or dependency thereof, or with any foreign government or state, including the power to sell or hire any of its steamships or sailing vessels, or other property of such governments or states, for any purpose whatsoever, whether naval, military, or otherwise. It is said that this amendment will meet the objection of the English Government to the effect that under the old charter that government could not have impressed any of the company's ships into its naval service in time of war.

Inspection of the Panama Canal Route.

An inspection of the route and works of the proposed Panama Canal will soon be made under the auspices of the existing Isthmian Canal Commission which has appointed a sub-committee of its members, consisting of Rear Admiral John G. Walker, U. S. Navy; Brig. Gen. Peter C. Hains, U. S. Army, and Prof. Burr, who will sail from New York this month to remain on the Isthmus for several months. Maj. William M. Black, Corps of Engineers, has been detailed by the President for duty with this sub-committee in connection with the purely

engineering features of the canal project, and to formulate a plan for improving the sanitary conditions of the canal route. Maj. Black is an authority on sanitary engineering, having served as Engineer Commissioner of the District of Columbia and afterward as City Engineer of Havana, Cuba, where he made important improvements.

Sundry Civil Appropriations.

These appropriations for the fiscal year ending June 30, 1904, foot up $82,272,955, of which about $20,225,000 is for continuing improvements on river and harbor works authorized under the Acts of 1892, 1896, 1899 and 1902. Among the most important of the 67 items of river and harbor improvement are: Continuing improvement of the Mississippi River from the Head of the Passes to the mouth of the Ohio River, and including the expenses of the Mississippi River Commission, $2,000,000; continuing improvement between St. Paul and Minneapolis, $223,579.33; improving the mouth of the Columbia River, Oregon and Washington, in accordance with the improved or modified project, $1,000,000; continuing improvement of St. Mary's River, Mich., $800,000; completion of the harbor of Waukegan, Ill., in accordance with the modified project, $240,000; completing the improvement of Calumet harbor, Chicago, Ill., $204,080; continuing improvement of harbor of Cleveland, Ohio, in accordance with plan for new harbor entrance and breakwater extension, $227,500; continuing improvement of harbor and channel and restoration of jetties, Galveston, Texas, $500,000; continuing improvement harbor of Savannah, Ga., $715,000; continuing improvement of channels, Gowanus Bay, N. Y., $272,000; continuing improvement of the channel from Kill von Kull to Raritan Bay, N. Y., $150,000; continuing improvement of Ambrose channel across Sandy Hook, $733,000; continuing improvement of harbor Southwest Baltimore, Md., $221,000, and for completing the improvement of Curtis Bay, Baltimore harbor, $146,000; continuing improvement of Ohio River below Pittsburg, Pa., and construction of dams Nos. 13 and 18, $450,000; continuing construction of breakwater, San Pedro harbor, Cal., $500,000; continuing improvement of Cumberland Sound, Georgia and Florida, $400,000.

In addition to the items of river and harbor improvement some of the other appropriations, in addition to various public buildings at Washington, D. C., previously noted in this column, are: For the U. S. Coast and Geodetic Survey, field expenses, including researches in physical hydrography, continuing magnetic observations, off-shore soundings, surveys of the Atlantic, Pacific and Gulf coasts of the United States, Hawaii and Alaska, a total, for field expenses only, of $264,900; and for a new steam vessel and outfit, $120,000. For the U. S. Geological Survey, for all purposes, in all $1,126,920. For the Interstate Commerce Commission, $275,000, and in addition to enable the Commission to keep informed regarding compliance with the Safety Appliance Act, $50,000. For work at the Capitol building at Washington and general and special repairs thereof, $295,950, and for two new steel water-tube boilers of about 225 h.p. for the Senate wing, $10,500. For the construction of buildings and enlargement of military posts and the erection of barracks and quarters for artillery and the purchase of sites in connection with coast defense projects, $1,500,000. For continuing the establishment of the military post near Manila, P. I., including barracks, quarters, water supply, sewerage, drainage and lighting, $1,000,000. And for continuing the improvement and enlargement of Governor's Island, New York harbor, $150,000.

Block System on C. G. W.

The Chicago Great Western is to establish the telegraph (manual) block system between Chicago and Byron, 83 miles. The block signal stations are about four miles apart, and the rules of the American Railway Association will be used. The signals will be put in use about April 13.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xvi.)

Western Railway Club.

The April meeting will be held in the Auditorium Hotel, Chicago, on Tuesday, April 21, at 2 o'clock. There will be a paper on "Design and Equipment of Railroad Shops," by Mr. George A. Damon, Managing Engineer, Arnold Electric Power Station Co., Chicago. The committee on recommendations for changes in the Rules of Interchange will make its report.

New England Railroad Club.

The regular meeting will be held on the evening of April 14 at the Massachusetts Institute of Technology, Lowell Building, Clarendon street, Boston. Prof. Wm. L. Puffer will lecture on "The Use of Polyphase Apparatus in Railroad Power Distribution," illustrating the same with the apparatus used at the Institute. The laboratory of the department will be open to the members during the evening.

PERSONAL.

—Mr. Joseph Park, a Director of the New York, New Haven & Hartford, and President of the well-known firm of Park & Tilford, of New York city, died at his home April 3.

—Mr. J. M. Johnson, who has been Third Vice-President of the Chicago, Rock Island & Pacific for several years, has become the Assistant to Mr. Bird, Traffic Director of the Gould Lines.

—Mr. H. C. Clements, General Auditor of the Texas Southern, died at his home in Kansas City, Mo., recently. He was born near Liverpool, England, in 1849, and entered railroad service in 1870 on the Kansas Pacific. He was at one time Auditor of the Atchison, Topeka & Santa Fe.

—Mr. Thomas A. Garrigan, Southeastern Passenger Agent of the Cleveland, Cincinnati, Chicago & St. Louis and the Chesapeake & Ohio at Huntington, W. Va., died April 2, aged 45 years. Mr. Garrigan was at one time President of the American Association of Traveling Passenger Agents.

—Mr. William Bennett, who has become Superintendent of the Wisconsin Division of the Chicago, St. Paul, Minneapolis & Omaha at St. Paul, began as a messenger boy, and passed through various subordinate positions (on different roads) such as operator, clerk, station agent, brakeman, conductor, train despatcher and trainmaster, until October, 1899, when he became Assistant Superintendent of what was then the St. Paul & Sioux City Division. In July the following year he was transferred to a similar position on the Wisconsin Division.

—Mr. James H. Hiland, who recently succeeded Mr. Bird as Third Vice-President of the Chicago, Milwaukee & St. Paul, began his railroad career on the Chicago, St. Paul, Minneapolis & Omaha as Assistant Traffic Director about 1882. In 1885 he left the railroad service, and for about two years was general agent of the Minneapolis Millers' Association of Minneapolis. In 1887 he became general agent of the Chicago, Milwaukee & St. Paul, and in February, 1889, he was made General Freight Agent, which position he held until 1900, when he became Traffic Director, from which position he is now promoted to become Third Vice-President.

—Mr. D. D. Robertson, the new Master Mechanic of the Kansas Division of the Chicago, Rock Island & Pacific at Herington, Kan., was born in 1868 in Forfarshire, Scotland. In 1883 he came to the United States and the same year began his railroad service as a machinist apprentice for the Minneapolis & St. Louis. In 1890 he resigned to go to the Chicago, Rock Island & Pacific as a machinist. Two years later he was appointed foreman of roundhouse at Pratt, Kan., and in 1899 was made general foreman at Herington. In 1902 he was made Master Mechanic of the El Paso Division, from which position he has been transferred to the Kansas Division as above.

—Mr. James G. Bateman, who on April 15 becomes the business manager of the T. H. Symington Company of Baltimore, manufacturer of railroad specialties, was for a number of years chief clerk to the Purchasing Agent of the Erie Railroad. He was born July 17, 1877, at Easton, Talbot County, Md., where he graduated from the High School. He afterwards was in Baltimore with Mr. J. R. Bland, Secretary, Merchants and Manufacturers Association. In 1895 he went to the Erie as a clerk in the car record office at Jersey City. In January, 1896, he was transferred to the General Superintendent's office, and in 1899 became chief clerk to the Purchasing Agent. Mr. Bateman is a young man of exceptional business ability, sterling integrity and unfailing honesty.

—Mr. Charles N. Chevalier, the new Purchasing Agent of the Boston & Maine, was born in New Hampshire in 1849, and began his railroad service on the Grand Trunk. He was chief train despatcher and trainmaster of the Eastern Division at Island Pond, Vt. In 1882 he went to the New York & New England as train despatcher and later became trainmaster and finally Superintendent. In 1891 he went to Central America as General Superintendent of Railways and Steamers for the Nicarauguan Government. In 1895 and '96 he was Superintendent of the Unadilla Valley, and the following year (1897) became General Superintendent of the Ogdensburg & Lake Champlain, where he remained until the road was bought by the Rutland Railroad. In 1900 he was made Fuel Agent of the Boston & Maine, which position he has held until now.

—Mr. W. W. Card, Second Vice-President of the Westinghouse Air-Brake Company, died at his home in Pittsburg, Pa., April 4. Mr. Card was returning from the company's factory and had just got off a street car in front of his home when he was struck by a car going the opposite way. He was born in Nelson, Madison County, N. Y., in 1831, and was a civil engineer of considerable prominence. In the early fifties Mr. Card had charge of the construction of the Cleveland, Lorain & Wheeling Railroad, and upon its completion was made its Chief Engineer. From there he went to the Pittsburgh, Cincinnati, Chicago & St. Louis as Superintendent at Columbus. About this time he met Mr. George Westinghouse. It was on Mr. Card's division that the first test of the air-brake was made, and a short time afterwards he became Sales Agent for the Westinghouse Air-Brake Company. In 1879 he was elected Secretary, from which he retired only last year with the honorary title of Second Vice-President. The historic air-brake test was on a local passenger train from Pittsburg to Steubenville, Oct. 3, 1869. Up to that time Mr. Card's railroad career was comparatively unimportant, just enough to develop him and enable him to know the life-saving value, which he keenly appreciated, as well as the worth to civilization, of Mr. Westinghouse's epoch-making invention. He began and for years kept up the work of spreading the usefulness of the continuous train brake with a zeal for it and a belief in it second only to that of its discoverer. He impressed railroad officers because he first impressed himself and then told the truth. In this work he was a great lieutenant. Personally, he was a charming, kindly gentleman, having those qualities which are the natural result of a highly developed humane instinct—the moving cause which decided him to devote himself to an invention which has saved many lives and made living easier.

Mr. Card was a member of the American Society of Civil Engineers. He had numerous business interests outside the air-brake company, and was President of the Pittsburg Screw & Bolt Company. He is survived by a widow, two sons and two daughters.

ELECTIONS AND APPOINTMENTS.

Addyston & Ohio River.—G. B. Hayes has been elected President. D. P. Hopkins, Superintendent, will assume the duties of Auditor also.

Annapolis, Washington & Baltimore.—C. F. Gladfelter has been appointed Auditor and A. E. Shaver, Superintendent and Traffic Manager, with headquarters at Annapolis, Md.

Atchison, Topeka & Santa Fe.—The Chicago Division of this company is to be divided. The line east of the Mississippi River is to be called the Illinois Division, headquarters at Chillicothe, Ill. The line west of the Mississippi River, including the St. Joseph Branch, will be called the Missouri Division, headquarters at Marceline, Mo.

Canadian Pacific.—J. G. Taylor, heretofore Superintendent of the Western Division at Brandon, Man., has been appointed Superintendent of the Crow's Nest Branch, with headquarters at Cranbrook.

Chicago & Alton.—E. V. Dexter has been appointed Purchasing Agent, with headquarters at Chicago, Ill.

Chicago, Burlington & Quincy.—Frank Beckwith, Division Engineer at Burlington, Iowa, has resigned. (See Lake Shore & Michigan Southern.)

Chicago, Milwaukee & St. Paul.—W. E. Tyler, heretofore Division Freight and Passenger Agent, has been appointed Assistant General Freight Agent, with headquarters at Chicago. Luis Jackson, Industrial Commissioner, has resigned to take a similar position with the Erie.

Chicago, Rock Island & Pacific.—C. H. Warren, heretofore Assistant to the President, was, on April 2, elected First Vice-President to succeed H. A. Parker, resigned. The resignations of J. M. Johnson, Third Vice-President, and F. E. Hayne as Treasurer and Assistant Secretary, were accepted. George H. Crosby, Secretary of the company, was elected Treasurer to succeed Mr. Hayne. C. F. Jilsen was appointed Assistant Secretary and H. E. Yarnall was appointed Assistant Secretary and Assistant Treasurer, with headquarters at Chicago. Mr. Johnson resigns to become Assistant to Mr. Bird, recently appointed Traffic Director of the Gould Lines.
See Colorado & Southern.

Cincinnati, Richmond & Muncie.—S. Brown has been elected Treasurer, with headquarters at Richmond, Ind.

Cleveland, Akron & Columbus.—George W. Davis has been appointed General Freight Agent, with headquarters at Columbus, Ohio.

Colorado & Southern.—A. L. Studer, heretofore Master Mechanic of the Rock Island, has been appointed Superintendent of Motive Power, with headquarters at Denver. W. A. George, hitherto Acting Superintendent of Motive Power, has resumed the duties of Division Master Mechanic.

Colorado Springs & Cripple Creek.—E. R. Walter, Superintendent of Terminals, with headquarters at Cripple Creek, Colo., has resigned and that office has been abolished.

Delaware, Lackawanna & Western.—G. J. Ray has been appointed Division Engineer, with headquarters at Scranton, Pa., succeeding J. I. Riegel, resigned.

El Paso Northeastern.—H. W. Ridgway, Superintendent of Machinery, with headquarters at Alamogordo, N. Mex., has resigned.

Erie.—See Chicago, Milwaukee & St. Paul.

Great Northern.—George W. Somers, heretofore General Freight Agent, has been appointed Assistant to the Fourth Vice-President. W. W. Broughton, succeeds Mr. Somers as General Freight Agent. The office of General Freight Agent of the Eastern Minnesota Division, heretofore held by Mr. Broughton, has been abolished. H. A. Kimball has been appointed Assistant General Freight Agent, with headquarters at St. Paul. M. J. Castello has been appointed Division Freight Agent at St. Paul. C. O. Jenks has been appointed Assistant Superintendent of the Eastern Division, with jurisdiction over the Second District, with headquarters at West Superior, Wis., and R. A. McCandless succeeds Mr. Jenks as Assistant Superintendent of the Dakota Division at Larimore, N. Dak.

Illinois Central.—S. T. Park has been appointed Master Mechanic, with headquarters at Centralia, Ill., succeeding J. H. Pollard, resigned.

Illinois Southern.—F. S. Lewis has been appointed Superintendent of this company and the Southern Missouri, with headquarters at Sparta, Ill., succeeding E. A. Burrill, resigned.

Iowa & St. Louis.—The jurisdiction of the officers of the Quincy, Omaha & Kansas City is extended over the I. & St. L. C. E. Dearborn has been appointed Chief Engineer in Charge of Construction, reporting to the General Manager at Kansas City, Mo.

Kanawha & Michigan.—G. W. Tompkins has been appointed Division Master Mechanic, with headquarters at Charleston, W. Va., succeeding T. M. Downing, resigned. (See St. Louis, Memphis & Southeastern.)

Kansas City Southern.—H. B. Johnson, heretofore Auditor of Disbursements, has been appointed Auditor, succeeding R. J. McCarty, resigned.

Lake Erie & Western.—J. N. Penwell has been appointed Supervisor of Bridges and Buildings, with headquarters at Tipton, Ind., succeeding T. J. Kinder, resigned.

Lake Shore & Michigan Southern.—Frank Beckwith, heretofore Division Engineer of the Chicago, Burlington & Quincy, has been appointed Principal Assistant Engineer of the L. S. & M. S.; office at Cleveland, Ohio.

Lehigh Valley.—G. N. Wilson has been appointed General Auditor, with headquarters at Philadelphia, Pa. George F. Morse, Assistant Engineer, with headquarters at Buffalo, N. Y., has resigned, effective May 1.

Maryland & Pennsylvania.—G. C. Smith has been appointed Master Mechanic, with headquarters at Baltimore, Md.

Mexican International.—F. W. Andros, heretofore Chief Engineer of the Chihuahua & Pacific, has been appointed Division Engineer of the M. I., with headquarters at Durango, Mex.

National of Mexico.—F. A. Lattig, heretofore Trainmaster, has been appointed Superintendent, with headquarters at Matamoros, Mex.

Nevada-California-Oregon.—J. G. Myers has been appointed Superintendent of Motive Power, with headquarters at Reno, Nev., succeeding G. W. Tompkins, resigned.

New York Central & Hudson River.—K. C. Weedin has been appointed Resident Engineer of the Middle, Eastern and River Divisions, succeeding L. W. Tucker, resigned.

Norfolk & Western.—J. B. Fuller, heretofore Assistant Engineer, has been appointed Assistant Superintendent of the Scioto Valley Division.

St. Louis, Memphis & Southeastern.—T. M. Downing has been appointed Master Mechanic, with headquarters at Cape Girardeau, Mo., succeeding W. B. Warren, resigned.

St. Louis Merchants Bridge Terminal.—Owing to ill health James Hanna, Auditor, has resigned, and C. A. Vinnedge has been appointed to succeed Mr. Hanna at St. Louis. H. D. Heuer has been appointed Assistant Auditor of this company and the Terminal R. R. Association of St. Louis.

Southern.—John A. Dodson, formerly Assistant to the General Manager, has been appointed Superintendent of Construction, in charge of double-tracking and new work. W. A. Vaughan, formerly Superintendent of the Atlanta Division, is appointed Assistant General Superintendent of the Western District. W. N. Foreacre, formerly Superintendent of the Mobile Division, is appointed Superintendent of the Atlanta Division, to succeed Mr. Vaughan, and J. J. Cotter becomes Superintendent of the Mobile Division, to succeed Mr. Foreacre.

The headquarters of R. Southgate, Engineer of Maintenance of Way, have been removed from Salisbury, N. C., to Greensboro.

Southern Missouri.—See Illinois Southern.

Toledo Railway & Terminal.—F. M. Cramer, heretofore General Agent of the Wheeling & Lake Erie, has been appointed Traffic Manager of the T. R. & T., with headquarters at Toledo, Ohio.

Toledo, St. Louis & Western.—Ed. Keane has been appointed Assistant General Freight and Passenger Agent, with headquarters at St. Louis, Mo.

Union Tank Line Co.—Willard Kells has been appointed Assistant Master Car Builder, with headquarters at 26 Broadway, New York City. C. A. Smith, Consulting Engineer, has retired.

Wabash.—D. Carson has been appointed Superintendent of Dining Car Service, with headquarters at Detroit, Mich., succeeding P. R. Myrick, resigned.

LOCOMOTIVE BUILDING.

The Chicago, Peoria & St. Louis is having three locomotives built at the Rogers Locomotive Works.

The Boca & Loyalton has ordered one 10-wheel locomotive from the Hicks Locomotive & Car Works.

The Drake Coal Company, Cleveland, Ohio, has purchased one switching locomotive from F. M. Hicks.

The Kansas, Mexico & Orient is having 15 locomotives built at the Cooke Works of the American Locomotive Co.

The Butte, Anaconda & Pacific is having one locomotive built at the Schenectady Works of the American Locomotive Co.

The San Pedro, Los Angeles & Salt Lake is having four locomotives built at the Schenectady Works of the American Locomotive Co.

CAR BUILDING.

The Canadian Pacific is building 100 refrigerator cars at its own shops.

The Mobile & Ohio is in the market for 1,000 gondola, 800 box and 200 stock cars.

The Copper Range has ordered 25 ore cars and two cabooses from the American Car & Foundry Co.

The Denver, Enid & Gulf has ordered one 55 ft. baggage car from the Hicks Locomotive & Car Works.

The Western of Alabama is having 70 freights built at the St. Louis Works of the American Car & Foundry Co.

The Dayton & Western Traction has ordered 15 standard gage, hopper-bottom ballast cars from the Apex Equipment Co.

The St. Joseph & Grand Island is having 50 freights built at the Hegewisch Works of the Western Steel Car & Foundry Co.

The Lake Shore & Michigan Southern is having 100 freights built at the West Detroit Works of the American Car & Foundry Co.

The Delaware, Lackawanna & Western order reported in our issue of April 3 should read Forsyth curtain fixtures and Edwards window fixtures.

The Pennsylvania is having six dining cars and four combination baggage and parlor smoking cars built at its Altoona shops for the Lines East of Pittsburg.

The Lake Shore & Michigan Southern, as reported in our issue of April 3, has ordered 250 flat cars from the Haskell & Barker Car Co. These cars are to be 40 ft. long, and 80,000 lbs. capacity.

The Keystone Coal & Coke Co., as reported in our issue of March 27, has ordered 200 P. R. R., class GL, steel hopper coal cars, and 50 P. R. R. class GSA coal cars from the Cambria Steel Co., Johnstown, Pa.

The Cincinnati, Richmond & Muncie has ordered 200 box cars of 60,000 lbs. capacity from the Laconia Car Works for June, 1903, delivery. The cars will weigh 30,300 lbs., and will be 36 ft. long, 8 ft. 4½ in. wide, and 7 ft. 1 in. high, inside measurement, with wooden frames and underframes. Special equipment includes Westinghouse brakes, Tower couplers and Diamond trucks.

The Chicago, Burlington & Quincy has ordered 2,000 drop bottom gondola cars of 100,000 lbs. capacity, divided equally between the Cambria Steel Co. and the Standard Steel Car Co., for May to September delivery. The cars will weigh about 40,000 lbs., and measure 40 ft. long, 9 ft. 4 in. wide, and 4 ft. 4 in. high, all inside measurements, 1,000 to be built of steel and 1,000 with steel framing and wooden siding and floor. The special equipment includes: Steel axles, Westinghouse air-brakes and arch bar type trucks.

The Mineral Range, as reported in our issue of March 27, has ordered 50 box cars of 60,000 lbs. capacity, and 100 hopper bottom ore or coal cars of 80,000 lbs. capacity, from the American Car & Foundry Co. for May, 1903, delivery. The coal cars will weigh 31,000 lbs., and will be 30 ft. long, 8 ft. 10 in. wide, and 8 ft. 4 in. high, with wooden frames and underframes. The special equipment for both includes steel axles, Common Sense body and truck bolsters, Congdon brake-shoes, Westinghouse brakes, National Fulton brasses, Janney couplers, Gould draft rigging, Harrison dust guards, McCord journal boxes, top hinge M. C. B. journal box lids, Railway Steel Spring Company's springs.

BRIDGE BUILDING.

AKRON, OHIO.—The City Commissioners will receive bids until noon, April 11, for a concrete steel bridge over the Little Cuyahoga River on the line of Cuyahoga street.

BLOOMINGTON, NEB.—The County Clerk is said to desire bids until April 21 for a steel bridge over Republican River.

BRADFORD, PA.—The city will vote on an ordinance providing for a $5,000 bridge over the Tuna on the site of Douglass dam.

BUSHKILL, PA.—A bill has been introduced in the Legislature incorporating the Pike-Sussex Bridge Co. to build a bridge over the Delaware River.

CAMDEN, N. J.—An ordinance has been prepared providing for a steel or iron bridge to take the place of the grade crossing at Broadway and Bulson street.

CHICAGO, ILL.—J. B. Cox, Chief Engineer, Chicago Junction Ry., will receive bids April 15, at 180 Exchange Building, U. S. Yards, for a 71-ft. steel bridge over West Forty-seventh street. The bridge will accommodate 10 tracks and about 500 tons of steel will be needed.

CLEVELAND, OHIO.—The County Commissioners will receive bids until 2 p.m., April 18, for a masonry arch bridge over the proposed new crossing of Euclid Creek on Euclid avenue in Euclid Township.

COVINGTON, IND.—The County Commissioners will receive bids at the auditor's office in Covington until noon, April 17, for four iron bridges.

DAYTON, OHIO.—The City Engineer is preparing an estimate of the cost of a bridge over Livingstone avenue under the Pennsylvania tracks.

T. J. Kauffman, County Auditor, will receive bids until noon, April 25, for a bridge 100 ft. x 16 ft., across Wolf Creek in Madison Township. Bids for masonry abutments will be received at the same time.

DECATUR, ILL.—According to newspaper report, a $6,000 bridge is to be built over Sangamon River at Coulter's Mill.

DEVIL'S LAKE, N. DAK.—The Pelican Point bridge will cost $10,000.

DOVER, DEL.—J. B. McCommons, Clerk of the Peace, will receive bids until April 12 for a bridge over Silver Lake in the Fifth Representative District.

DURHAMVILLE, N. Y.—A bill has been introduced in the Legislature authorizing a $57,000 viaduct for Oneida Creek.

ELIZABETH, N. J.—A $3,500 bridge will probably be built at Elm street.

EVANSVILLE, IND.—The old wooden bridge over Pigeon Creek in Maryland street will probably be replaced by a steel bridge.

FREDERICTON, N. B.—C. H. LaBillois, Commissioner of Public Works, asks for bids for bridges as follows: April 20, substructure and superstructure of a bridge over Shepody River at Harvey; May 18, steel superstructure for Oromocto highway bridge, Parish of Lincoln, Sunbury County, to consist of one fixed truss span 97 ft. 4½ in., and one swing draw span of 215½ ft.

GENOA, W. VA.—It is said the County Commissioners will build a bridge over Upper Coal Branch in Wayne County.

HALLETTSVILLE, TEXAS.—An election will be held May 2 to decide the question of issuing $25,000 bridge bonds.

INDIANAPOLIS, IND.—According to report, the Commissioners of Marion County are asking bids until April 16 for six new bridges.

LEWISTON, PA.—Viewers favor a new bridge at Broughts Fording.

MENASHA, WIS.—A bridge is proposed across Little Lake Buttes des Morts, connecting this place with West Menasha.

MOLINE, ILL.—A steel viaduct will be built over the Chicago, Rock Island & Pacific tracks at East Moline.

MT. VERNON, OHIO.—The County Auditor will receive bids until April 16 for $40,000 of bridge bonds.

NANTICOKE, PA.—W. H. Brown, Chief Engineer, writes that the Pennsylvania R. R. is not planning to build a bridge across the river at this place, as reported in various papers.

NEWARK, N. J.—The County Engineer has prepared plans for a 1,730 ft. bridge over Hackensack River, to cost about $500,000. The proposed bridge over Passaic River will be 793 ft. long, to cost about $280,000.

NEW GLASGOW, N. S.—The County Council is considering a steel bridge across the river at this place.

NORFOLK, VA.—Plans have been prepared for the Naval hospital bridge and an appropriation of $5,000 is available.

NORRISTOWN, PA.—Montgomery County Commissioners propose to build two new bridges over Perkiomen River.

NORTH ADAMS, MASS.—Plans being prepared for the elimination of grade crossings require a viaduct on State street.

PLAINFIELD, N. J.—The freeholders of Union and Somerset Counties will build a bridge over Green Brook. Bids have not yet been advertised for.

PONTIAC, MICH.—The City Engineer has prepared plans for new bridges over Clinton River at East Pike and Water streets.

RENSSELAER, N. Y.—The Common Council has petitioned the State Railroad Commissioners to order a bridge over the tracks on Third avenue to East street.

RIVERVIEW, MONT.—A bridge will be built over the Clarke Fork River.

ROBY, TEXAS.—The county has voted to issue $19,000 bonds for bridge purposes.

SAGINAW, MICH.—The Board of Public Works will receive until 7:30 p.m., April 16, competitive plans for a liftbridge over the Saginaw River.

ST. LOUIS, MO.—The World's Fair Company will build a temporary viaduct for foot passengers over the Wabash tracks at De Boliviere avenue.

SANTA BARBARA, CAL.—An issue of $20,000 bridge bonds is proposed.

SEYMOUR, CONN.—The town has voted to build a bridge at the junction of Pine and Meadow streets.

SPOKANE, WASH.—The city proposes to join the county in building an $86,000 bridge over Latah Creek instead of a wooden bridge, as at first proposed.

STINERS, B. C.—Contracts will soon be let for a bridge over Nooksack River by the Bellingham Bay & British Columbia Railroad.

SYRACUSE, N. Y.—The Mayor has signed an ordinance providing for a $6,000 bridge at West Fayette street.

TINTON FALLS, N. J.—The Board of Freeholders will build an iron bridge across the dam at this place, to cost about $7,000.

TROY, N. Y.—The Troy & Colonie Bridge Co. has been organized with $150,000 capital to build a toll bridge over Hudson River from the foot of Hutton street.

WASHINGTON, D. C.—The following bids were received for rebuilding pier 5 of the Aqueduct bridge: Penn Bridge Co., Beaver Falls, Pa., $54,956; McMullen & McDermott, of New York, $61,685, and Foundation & Constructing Co., of New York, $57,007.

WILMINGTON, DEL.—The Road Commissioners have petitioned the Levy Court for a bridge on Woodward Road over Pine Creek.

Other Structures.

BRENHAM, TEXAS.—It is said that the Gulf, Colorado & Santa Fe will build a new passenger station.

CARBONDALE, ILL.—It is said that the Illinois Central has prepared plans for a new station.

CINCINNATI, OHIO.—According to report, the Norton & Coles Machinery Co. will erect a shop 80 ft. x 300 ft. at Norwood.

CLEVELAND, OHIO.—The Horsburg Forging Co. will erect a forge and machine shop 50 ft. x 100 ft.

ELLWOOD CITY, PA.—According to report, the Pittsburgh & Lake Erie and the Baltimore & Ohio will soon build a union passenger station.

EL PASO, TEXAS.—The El Paso Union Depot Co. has been organized with a capital of $250,000 to build a new union passenger station.

HAVERSTRAW, N. Y.—It is said that the New York Central will build a new passenger station.

MENOMINEE, MICH.—A new station will be built at the south end of Kirby street by the Chicago, Milwaukee & St. Paul.

NELSON, B. C.—According to report, the Canadian Pacific Ry. will build a new machine shop 100 ft. x 72 ft.

POPLAR BLUFFS, MO.—The Missouri Pacific will build a new passenger station to cost about $20,000.

PORTLAND, ME.—The Portland Iron & Steel Co., it is said, will rebuild the shop at South Portland which was burned last fall.

WINSTON-SALEM, N. C.—The Southern Ry., it is understood, proposes to erect a $30,000 passenger station.

RAILROAD CONSTRUCTION.

ALABAMA ROADS.—The Lewin Lumber Co. will build a logging road from its mills near Attalla, Ala., south to Etowahton, 15 miles. This company has recently purchased a large amount of timber lands in Etowah and St. Clair Counties, and the road is to be built to connect the new land with the mills.

ALLEGHENY & WESTMORELAND.—This company has been granted a charter to build from a point near Port Perry, Allegheny County, Pa., southeast to a point in Westmoreland County near Mt. Pleasant, about 28 miles. W. B. Linn is President; T. B. Franklin, E. S. King, C. C. Bent, Geo. H. Stein and others, of Philadelphia, are directors.

BERING SEA & COUNCIL CITY.—It is reported that plans have been completed for building this line between Nome and Council City, Alaska, 80 miles, and that surveys for the new line will shortly be made. John J. Habaeker, of Philadelphia, Pa., is said to be interested.

BUFFALO, ROCHESTER & PITTSBURGH.—Clements, Kane & Shoemaker, Philadelphia, have taken the contract for building the extension of this line from Creekside, Pa., to the Elders Ridge coal field, 17 miles. Work will be begun immediately.

CALIFORNIA ROADS.—It is reported that a contract has been let to Stone & Co., of Oakland, Cal., for the building of a 50-mile line in Butte County. It will have one terminus at Chico, where the Diamond Match Co. is now erecting a large factory. No official information as to who is building the road has been received.

CEDAR FALLS & NEW HARTFORD.—Work is reported in progress on this new line from Cedar Falls, Iowa, west to New Hartford, 10 miles Murray & Ward, Cedar Rapids, are the contractors.

CENTRAL FLORIDA & INDIAN RIVER.—Articles of incorporation have been filed by this company in Florida to build from Melbourne, through Brevard, Osceola and Polk Counties, to Orlando in Orange County. J. G. Jenkins, Jr., Edward Morrison and others, of Melbourne, Fla., are interested.

CENTRAL OF ARKANSAS.—An officer writes that the proposed route of this road is from Paris, Ark., east via Dardanelle and Ola, and thence in a southerly direction to Hot Springs, 90 miles. Surveys are now being made and the prospects of beginning work in a short time are good. F. A. Molitor, Little Rock, is President and Chief Engineer. (March 27, p. 240.)

CHARLESTON, CLENDENNIN & SUTTON.—Bids have been received by this company for the building of a branch 25 miles long, extending from Big Otter up the Elk River, in Clay County, W. Va., to a connection with the Coal & Coke R. R. Contract will shortly be let. H. G. Davis is President of the company.

CHESAPEAKE & OHIO.—Press reports state that this company has decided to enlarge the Allegheny tunnel west of Covington so as to have a double track through it. It is said that work will be begun in the near future. The tunnel is 4,703 ft. long and it will require six or eight months to complete the work.

CHICAGO GREAT WESTERN.—Work has been resumed on the Council Bluffs extension of the Mason City & Fort Dodge Division of this company. The grading crews are at work between Botna and Council Bluffs. It is reported that the entire line will be completed about July 1. (See Construction Supplement.)

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—Bids are being asked by this company for the grading and excavating for a second track between Lawrenceburg Junction and Sunmans, Ind., 18 miles. The work involves moving approximately 2,000,000 cu. yds. of material from excavations and placing it in embankments. Bids will close at noon, April 20. Geo. W. Kittridge, Cincinnati, Ohio, is Chief Engineer.

COAHUILA & ZACATECAS.—A contract has been let to J. D. Melville, Saltillo, in the State of Coahuila, Mexico, to build two branch lines, one from Avalos to San Pedro, 19 miles, and the other to Bonanza, seven miles.

COAL BELT.—Incorporation has been granted this company in Illinois to build from the Ohio River through Pope, Hardin, Saline and other counties to a connection with the Chicago & Eastern Illinois in Williamson County. F. C. Peabody, Arthur W. Underwood, J. D. Adams and J. B. Russell, all of Chicago, are incorporators.

CONFLUENCE & MORGANTOWN.—A charter was granted this company on March 27 to build from Confluence, Somerset County, Pa., southwest to a point on the State line of Pennsylvania and West Virginia, in Fayette County, 25 miles. W. B. Linn is President; T. B. Franklin, E. S. King, J. C. Richardson, Geo. H. Stein and others, all of Philadelphia, are interested.

CONNECTICUT RAILWAY & LIGHTING.—Contract has been let to C. W. Blakeslee & Sons for building a trolley line from Ansonia to Seymour. This line will make the link from Seymour to Waterbury complete with the exception of the distance between Seymour and Naugatuck. A petition for right of way between these two latter places is now pending in the State Legislature.

CURWENSVILLE & BOWER.—A charter was granted to this company on March 31, in Pennsylvania, to build from a point on the Clearfield & Mahoning, to a point on the Beech Creek near Bower, Clearfield County, a distance of 16 miles. M. E. Olmsted, Harrisburg, is President. W. H. Newman and E. V. W. Rossiter, New York, and W. D. Kelly, of Philadelphia, are directors.

DENVER & RIO GRANDE.—Contract has been let to Kilpatrick Bros. & Collins for the extension of this road from Marysvale, Utah, southwest to Parowan, and thence to the iron mines of the Colorado Fuel & Iron Co., in Iron County, about 50 miles. Work will be begun immediately.

ELIZABETH CITY & CAROLINA.—A charter has been granted this company to build from Wilmington, N. C., northeast to Elizabeth City, 150 miles. R. G. Grady, S. P. McNair, of Wilmington, and others are interested.

GRAND TRUNK PACIFIC.—A petition for the incorporation of this company has been filed at Ottawa, Ont. The proposed route of the new road is from Quebec to Gravenhurst, on North Bay, thence in a northwesterly direction to Lake Nepigon, Winnipeg, Battleford and Edmonton, and thence by either the Peace River Pass or the Pine River Pass to Port Simpson. Geo. A. Cox and G. R. Wood, of Toronto; J. R. Booth, of Ottawa; Hon. H. B. Rainville, of Quebec, and others are interested.

GREAT NORTHERN.—Work is reported begun on the branch which this company is building from Vancouver, B. C., east to New Westminster, 12 miles. This line, when completed, will enable the Great Northern to greatly reduce the time of passenger trains between Portland and Vancouver.

GREENE COUNTY.—Contracts will be let in the near future for building this road from Bishop, Pa., southeast, passing through Washington County and thence through Meadowlands and Arden, and through Greene County to Uniontown, Fayette County. Rights of way for the entire line have been secured and surveys have been completed. The men who are interested in this road are all associated with the Wabash system.

HARTFORD & WORCESTER STREET.—This company has been organized in Massachusetts, and proposes to build from Worcester, Mass., southwest to Hartford, Conn., passing through Leicester, Charlton, Sturbridge, Brimfield, Wales and Holland, Mass., 81 miles. F. C. Hinds, Boston, is President, and Thomas C. Perkins, Hartford, Vice-President.

ILLINOIS RAILWAY & LIGHT.—This company has been incorporated, with a capital stock of $3,000,000, for the purpose of acquiring, building and operating street and interurban lines. J. M. Mitchell, Warren N. Ackers and B. B. Lewis, all of 15 Exchange Place, Jersey City, N. J., are incorporators.

JENNINGS & NORTHERN.—Articles of incorporation have been filed by this company in Louisiana. The capital stock is $3,000,000. It is proposed to build lines north and south of Jennings. E. F. Rowson is President, and C. E. Wooten is Attorney, Lake Charles, La.

KANSAS CITY, BEATRICE & WESTERN.—Surveys are reported completed for this line from Virginia, Neb., west to Beatrice, 15 miles. Work will be begun immediately. J. E. House, Beatrice, Neb., is Chief Engineer. The line will parallel the Chicago, Rock Island & Pacific for the greater part of the distance.

KENTON & SOUTHERN (ELECTRIC).—A contract has been let to the Great Northern Construction Co. for building the Kenton Interurban line of this company and the extension southwest to Bellefontaine, Ohio, 25 miles. Work will be begun about April 15.

LITCHFIELD & ST. LOUIS.—This company has been incorporated in Illinois. It is proposed to build a line one mile long from a point on the Cleveland, Cincinnati, Chicago & St. Louis, east of Litchfield, Montgomery County, Ill., to a point south of Litchfield. Chas. B. Munday, Daniel W. Taylor and others, of Litchfield, Ill., are directors.

LOUISVILLE & NASHVILLE.—Contract has been let to Dunn & Lellande for building the extension of this road to the new mines which have been opened at Lehigh, Blount County, by the Lehigh Coal Co.

Surveys are reported for the extension of the Atlanta, Knoxville & Northern Division of this company from Ducktown, Tenn., west to Chattanooga, 50 miles.

LUBEC & MACHIAS.—A bill has been introduced into the Maine Legislature for the incorporation of this company, with power to build from Lubec, Me., via Whiting, Cutler, East Machias and Machiasport, all places near the coast, to Machias, 35 miles. E. M. Pike, J. C. Pike and J. H. Gray, of Machias, are said to be interested.

MARTINS CREEK & RIVERTON.—Charter has been granted this company to build a steam railroad from Martins Creek, Northampton County, Pa., in a northerly direction to a point near the intersection of the Bangor & Portland and the Pennsylvania at Bridge. R. A. Montgomery, Lambertville, N. J., is President; Henry Clark, E. J. Fox, E. C. Clifton and others, of Easton, Pa., are directors.

MONTREAL & JAMES BAY.—The Quebec Legislature has passed an act incorporating this company with power to build from Montreal to a point on James Bay.

NEW BRUNSWICK ROADS.—The Intercolonial Copper Co. is about to build a road three or four miles long to connect its mines with the Intercolonial at Dorchester, N. B. A. W. Chapman is General Manager, Dorchester, N. B.

NEWBURG & SOUTH SHORE.—A contract has been awarded to William Kenefick, Kansas City, Mo., to build this belt line at Cleveland. The road is in the interest of the American Steel & Wire Company, and when completed will be about 7½ miles long.

NEW CASTLE & EASTERN.—This company has been organized in Pennsylvania, to build from Rose Point to New Castle, eight miles. The city of New Castle will be reached by using the narrow gage line of the Marquis Limestone & Clay Company. E. N. Ohl is President; J. E. Norris, Second Vice-President, and E. F. Norris, Secretary and Treasurer, all of New Castle, Pa.

NORLINA, WARRENTON & CAROLINA CENTRAL.—A charter has been granted this company to build from Norlina, N. C., south through Warren, Franklin, Nash and other counties to a connection with the Atlantic Coast Line at Chadburn, in Columbus County, a total of about 150 miles.

OAKLAND & EAST SIDE.—An officer writes that this company is now building a standard gage road from Richmond, Contra Costa County, Cal., to Emeryville, in Alameda County, 11½ miles. Oregon fir ties, broken rock ballast, 85-lb. steel rails, concrete and arch culverts will be used. The Atchison, Topeka & Santa Fe owns the stock of the Oakland & East Side.

OREGON SHORT LINE.—The Utah Construction Co. has recently been awarded a contract for building the Malad branch of this company from Corinne, Utah, north to Garland, 10 miles. (See Construction Supplement.)

PEOPLE'S RAPID TRANSIT.—Incorporation was granted this company in Ohio on March 30 to build and operate an electric railroad from Cincinnati north to Toledo. The company is capitalized at $500,000, and the incorporators include Louis Weadock, Adam Berger, Thomas M. Franey and others.

PHILADELPHIA INTERURBAN.—This company has been incorporated with a capital stock of $2,500,000 for the purpose of acquiring and purchasing railroads and railroad stocks. E. H. Chew, Walter J. Parsons and B. R. Boyer, all of Camden, N. J., are incorporators.

QUEBEC & LAKE HURON.—It is reported that the contract has been let for building this line from Quebec to a point on the French River near Lake Huron. Work will probably begin about May 1. H. G. Carroll, Quebec, is interested. (See Construction Supplement.)

QUINCY & WESTERN ILLINOIS.—Incorporation has been granted this company in Illinois, to build lines from Quincy, east to Beardstown, 50 miles, from Rushville northeast to Havana, 30 miles, and from Quincy west to Niota, 45 miles. S. M. Bracey, A. B. Nettleton and L. J. Highland, all of Chicago, are interested.

RICE BELT.—This company has been organized to build a line from Galveston, Texas, southwest along the Gulf coast to Brownsville, near the mouth of the Rio Grande River. The company is capitalized at $1,000,000, and the general offices will probably be at Port Lavaca. R. L. Clark is President; H. E. Masterson, Vice-President, and W. G. Peterson, Secretary.

SEABOARD AIR LINE.—Surveys are reported for a branch line in Russel County, Alabama, with a terminus at Opelika.

SHREVEPORT & RED RIVER VALLEY.—Contracts have been let to Winston Bros., of Minneapolis, and to Lee & Craney Bros., Kansas City, for grading an extension of this line from Baton Rouge along the Mississippi River for a distance of 50 miles. Final destination of the line is not stated; it is supposed to be New Orleans. Work will be begun at once.

SOUTHERN.—The re-laying of the track of the Spartanburg Branch of this company will be begun shortly. New track is already down from Spartanburg to a point near Saluda, Tenn., but the remaining part of the line to Asheville will be re-laid with 80-lb. rails.

TACOMA & EASTERN.—Surveys are reported in progress on an extension of this line from Eatonville, Pierce County, Wash., south to a connection with the Portland, Vancouver & Yakima at Amboy, 65 miles. The work will be begun as soon as the surveys are completed.

UNION SPRINGS & NORTHERN.—See Railroad News.

VANCOUVER, VICTORIA & EASTERN.—Right of way has been secured for the extension of this road to Phœnix, B. C., and work will be begun at once. J. H. Kennedy, Grand Forks, B. C., is Chief Engineer.

WYOMING & BLACK HILLS.—This company has recently been incorporated in Wyoming to build a line from Upton, Wyo., on the Chicago, Burlington & Quincy, northeast to Belle Fourche, S. Dak., 75 miles. A. E. Johnson, E. G. Potter and C. T. Wallace, of Minneapolis, are incorporators. Work will probably be begun early in the summer. (See April 3, p. 256.)

ZANESVILLE, MARIETTA & PARKERSBURG (WABASH).—A contract has been let to McArthur Bros. for the grading of this line from Zanesville, Ohio, to Parkersburg, W. Va., 70 miles. This road, when completed, will join the Wabash lines in Ohio with those controlled by it in West Virginia. T. J. Blair, President of the Little Kanawha, is also President of this company. The new line will include three tunnels, one of which will be 1,800 ft. long, and the contract calls for the completion of the work within a year.

GENERAL RAILROAD NEWS.

New Incorporations, Surveys, Etc.

ALBANY & HUDSON.—The State Board of Railroad Commissioners has authorized this company to issue a mortgage for $2,000,000. Of that amount $1,500,000 is to be issued at once. These bonds are to be issued under the reorganization plan, by which the property passes from the control of the Albany & Hudson Ry. & Power Co. to the Albany & Hudson Railroad Co.

CINCINNATI, RICHMOND & MUNCIE.—This company will be known in future as the Chicago, Cincinnati & Louisville. W. A. Bradford, of Boston, has been elected President.

GRAND RAPIDS & INDIANA.—The gross earnings of this company for the fiscal year ending Dec. 31, 1902, were $4,014,776, as against $3,654,725 in 1901, an increase of $360,050. Operating expenses increased $298,083, leaving net earnings of $959,356, an increase of $61,967. Freight earnings increased $162,270, or 9 per cent., but the average rate per ton mile remained the same. Passenger earnings increased $135,695, or about 15 per cent. The increase in expenses was due to renewals, additional sidings, and the straightening and improvement of the main line at various points.

HALIFAX & SOUTH WESTERN.—Mackenzie & Mann, who are building this Nova Scotia road, have bought the Nova Scotia Central and will make it a part of the new system. A bill was presented before the Nova Scotia Legislature on March 26 to ratify the sale. The amount of money transferred in the sale appears to be $525,000, of which $425,000 is advanced by the Provincial Government. For this the Government takes a first mortgage. The sale is financed by the Halifax Banking Company.

LITTLE ROCK RY. & ELECTRIC CO.—This company is the successor of the Little Rock Traction & Electric Co., incorporated June, 1895. The management of the property has been transferred from the Union Securities & Electric Co., of Boston, to Isidor Newman & Son, New York City. The capital stock of the new company is to be $2,250,000.

MANHATTAN (ELEVATED).—An application to the New York Stock Exchange for the listing of new stock certificates of the Manhattan Ry. Company has been approved. These new certificates will be known as guaranteed stock, and will be issued in exchange for the old shares of the company. This change in form is due to the recent lease of the Manhattan by the Interborough Rapid Transit Company. The terms of the lease have already been published in our issue of Dec. 5, p. 934. On the new stock the Rapid Transit Company guarantees dividends of 7 per cent.

MORNING STAR.—Bonds to the amount of $3,500,000 have been placed by this company with the Equitable Trust Co. of New York, as trustee. The proceeds from the sale of the bonds will be used to pay for an extension from Newport, Ark., northwest to Fellville, Marion County, 80 miles.

NEW YORK, NEW HAVEN & HARTFORD.—The $16,397,200 4 per cent. debenture bonds of 1893 are now convertible into new stock at par. Bonds amounting to about $15,500,000 have already been sent in for conversion. (February 27, p. 160.)

ST. LOUIS & SUBURBAN.—A mortgage for $7,500,000 has been filed by this company with the Mississippi Valley Trust Co. as trustee. The mortgage provides for the issuance of 5 per cent. 20 year gold bonds. It is proposed to consolidate five different companies, operating portions of suburban systems.

SOUTHERN PACIFIC.—Judge Lurton, of the United States Circuit Court of Appeals, has refused to make permanent the injunction asked for by Talbot J. Taylor & Co., of New York, to restrain the Harriman interests from voting the 900,000 shares of stock held by the Union Pacific Company, at the Southern Pacific election on April 8. A temporary injunction was granted about a week ago. Complainants gave notice of appeal to the United States Court of Appeals and asked that pending the hearing of this appeal, the annual meeting of the stockholders set for April 8 be indefinitely postponed. It was agreed that the stockholders should meet, and after electing a chairman, should adjourn until the case was decided by the Court of Appeals.

UNION SPRINGS & NORTHERN.—This company recently authorized the issue of $1,000,000 in bonds, the proceeds to be used in extending the road from Fort Davis, Ala., to Rockford, Coosa County, 60 miles. The road now runs from Union Springs to Fort Davis 7½ miles. W. M. Blount, Union Springs, Ala., is President.